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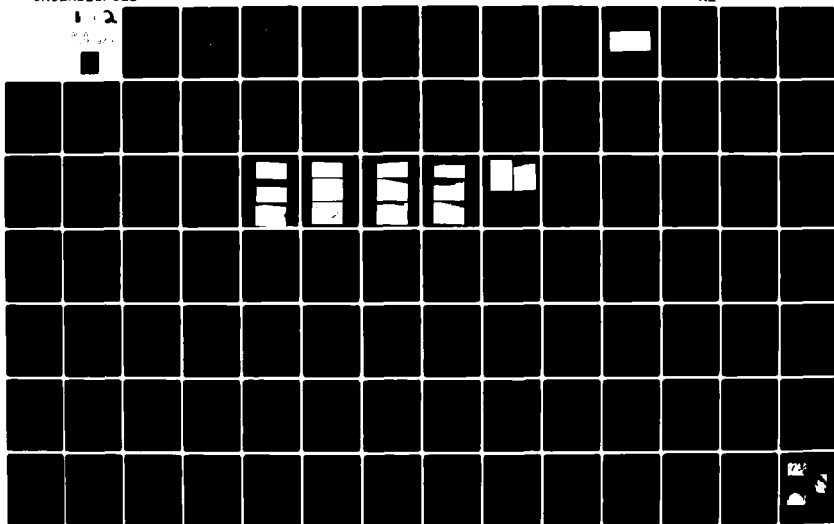
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NATIONAL DAM SAFETY PROGRAM. ISCHUA CREEK WATERSHED PROJECT, SI--ETC(U)
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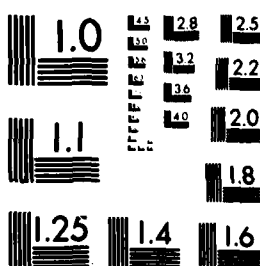
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Dam Safety
National Dam Safety Program
Visual Inspection
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Ischua Creek Watershed
Ischua Creek - Site 4
Cattaraugus County
Allegheny
Saunders Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of available engineering documents and visual inspection of the Ischua Creek Site 4 Dam did not reveal conditions which constitute a hazard to human life and property.

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ALLEGHENY RIVER BASIN
ISCHUA CREEK WATERSHED PROJECT
SITE 4

CATTARAUGUS COUNTY, NEW YORK
INVENTORY NO. N.Y. 626

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



Prepared by
THOMSEN ASSOCIATES
105 CORONA AVE. GROTON, N.Y.

Prepared for
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEER
NEW YORK, NEW YORK
JULY 1980

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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 PHASE I INSPECTION REPORT
 NATIONAL DAM SAFETY PROGRAM,
 ISCHUA CREEK WATERSHED PROJECT,
 SITE 4
 (I.D. ~~NO~~ N.Y. 626),
 Number
 ALLEGHENY RIVER BASIN,
 CATTARAUGUS COUNTY, NEW YORK.
 Phase I Inspection Report

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

NAME OF DAM: Ischua Creek Watershed
Ischua Creek-Site 4
Inventory No. N.Y. 626

STATE LOCATED: New York

COUNTY: Cattaraugus County

RIVER BASIN: Allegheny

STREAM: Saunders Creek

DATE OF INSPECTION: May 6, 1980
See Vicinity Map & Topographic Map,
Appendix F

ASSESSMENT


The examination of available engineering documents and visual inspection of the Ischua Creek Site 4 Dam did not reveal conditions which constitute a hazard to human life and property.

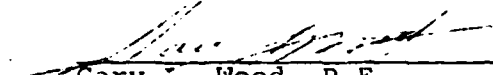
The total discharge capacity of the combined principal and auxiliary spillways is adequate to impound and safely discharge the floodwater resulting from the Probable Maximum Flood, therefore, the spillway is deemed to be adequate.

The computed maximum discharge velocities in the auxiliary spillways are in excess of that normally accepted for grass-lined channels.

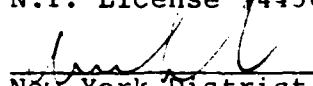
Deficiencies noted for this structure include cracks in the principal spillway outlet pipe and an inoperable reservoir drain gate. These deficiencies were known in advance of this inspection and plans were initiated to correct same during the Summer of 1980. An investigation into auxiliary spillway erodability during periods

of heavy runoff should be completed within 18 months from the time of approval of this report. In addition, an emergency preparedness plan for notification and evacuation of downstream residents should be developed within 6 months.


Bent L. Thomsen, P.E.
Thomsen Associates
N.Y. License #40553


Gary L. Wood, P.E.
Thomsen Associates
N.Y. License #44504

APPROVED BY 10 SEP 1980


New York District Engineer
Colonel W. M. Smith, Jr.



View of upstream slope from
north side of embankment

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
ISCHUA CREEK WATERSHED PROJECT
SITE 4
I. D. No. N.Y. 626
ALLEGHENY RIVER BASIN
CATTARAUGUS COUNTY, NEW YORK

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the New York State Department of Environmental Conservation by Contract No. D-201458. This study was performed in accordance with the terms of the above contract and the "Recommended Guidelines for Safety Inspection of Dams" to fulfill the requirements of the National Dam Inspection Act, Public Law 92-327.

b. Purpose of Inspection

This inspection was conducted to obtain available data concerning design and construction of the dam, evaluate said data, to inspect existing conditions at the dam, to identify and evaluate deficiencies and/or hazardous conditions which may threaten life and property of downstream residents, and to recommend additional or remedial action to mitigate such hazards where required.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam

The Ischua Creek Watershed Project Site 4 consists of an earth dam with a principal spillway outlet pipe passing from a reinforced concrete riser structure through the

embankment and two (2) grass lined earth auxiliary spillways passing around the north and south ends of the embankment.

The dam embankment, which is composed of compacted glacial till soils, has a height of 51 feet, a crest length of 900 feet and a crest width of 18 feet. The upstream slope is 1 vertical on 3 horizontal and the downstream slope is 1 vertical on 2.5 horizontal. The crest and exposed slopes are grass covered. An earth cutoff trench of varying depth and width keys the embankment into relatively impervious foundation soils. The principal spillway consists of a 3 foot by 9 foot I.D. reinforced concrete riser structure, a 36 inch I.D. circular reinforced concrete pipe, and a plunge pool cut into glacial till and lined with 18 inches of riprap. Normal pool elevation is maintained by an orifice in the riser structure at elevation 1684.2. A reservoir drain consisting of a 24 inch I.D. bituminous coated corrugated metal pipe extends from a point in the reservoir east of the riser structure to the base of the riser structure. A vertical slide gate mounted along the upstream side of the riser controls the flow through the reservoir drain.

Two auxiliary spillways along the north and south ends of the embankment are cut primarily into dense glacial till soils. The north auxiliary spillway has a bottom width of 100 feet whereas the south auxiliary spillway is 200 feet wide at the base.

The dam has an internal drainage system consisting of a toe drain trench filled with sand and gravel filter material with 8 inch diameter perforated bituminous coated corrugated metal (B.C.C.M.) collector pipes bedded in the filter material at the base of the embankment near the downstream toe. The perforated pipe section of the drainage system is parallel to and 88 feet downstream from the dam centerline. Seepage is collected and diverted through this pipe

to a non-perforated 8 inch diameter B.C.C.M. pipe and outletted to either side of the principal spillway outlet pipe into the plunge pool. (These outlets are shown on the photo of the outlet pipe and plunge pool.)

b. Location

The Ischua Creek Watershed Project Site 4 is located on Saunders Creek approximately 3/4 mile northeast of the Village of Franklinville.* A two lane asphaltic concrete road (Hardy Road) crosses Saunders Creek approximately 2000 feet downstream of the dam and parallels the south auxiliary spillway.

c. Size Classification

The dam is 51 feet in height and has a maximum storage capacity of 1011 acre-feet (top of embankment). This structure is therefore in the intermediate size category as defined by the Corps of Engineers, Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The dam is classified as high hazard because of the number of residents located along the downstream channel in the Village of Franklinville.

e. Ownership

The dam is owned and operated by the Cattaraugus County Watershed District. The local contracting officer is Mr. Edward Smith of Franklinville, New York. His telephone number is 716-676-3427.

f. Purpose of Dam

The dam is a floodwater retarding structure.

g. Design and Construction History

The dam was designed by U. S. Department of Agriculture, Soils Conservation Service (SCS) between the period 1959

*Note that the SCS Design Report has this direction reversed.

through 1961. The dam was constructed by Sack Brothers, Inc. during the period from August 1962 to September 1963. The SCS office in Syracuse, New York has the design report which contains hydrologic-hydraulic data, soils and geology reports, and a stability analysis of the embankment. In addition, this office has the as-built drawings, contract documents and other pertinent data related to this structure.

h. Normal Operational Procedure

Normal flows are discharged through an orifice in the intake riser structure through the principal spillway. The orifice is the primary control when the reservoir is between elevations 1684.2 and 1703.2. Reservoir levels between 1703.2 and 1713.0 are discharged through both the orifice and over the riser crest. The reservoir has sufficient capacity to store and the principal spillway to discharge 237 cfs without discharge occurring in the auxiliary spillways.

1.3

PERTINENT DATA

<u>a. Drainage Area</u> (sq. mil)	4.1
<u>b. Discharge at Damsite</u> (cfs)	
Reservoir Drain at Orifice Crest (1684.2)	70
Orifice at Riser Crest (1703.2)	110
Principal Spillway at Auxiliary Spillway Crest (1713.0)	237
Principal Spillway at Design High Water (1715.9)	243
Auxiliary Spillway at Design High Water (1715.9)	4457
Total Spillway Capacity at Top of Dam (1717.2)	8650
<u>c. Elevation</u> (ft. above MSL, taken from Design Report and As-built Drawings)	
Top of Dam	1717.2
Design Maximum High Water	1715.9
Sediment Pool - Orifice Crest	1684.2
Intake Riser Crest (Principal Spillway)	1703.2
Auxiliary Spillway Crest	1713.0
Steambed at Centerline of Dam	1666.2

d. Reservoir (ft)

Length of maximum pool	3700
Length of sediment pool	300

e. Storage (acre-feet)

Sediment Pool (taken from Design Report)	31
Crest of Riser (flood storage above sediment pool)	302
Design High Water(flood storage above sediment pool)	912
Top of Dam (flood storage above sediment pool)	1011

f. Reservoir Surface (acres)

Sediment Pool	5.6
Crest of Riser	26.2
Design High Water	73.0
Top of Dam	80.0

g. Dam (Taken from Design Report)

Type: Homogeneous Earth Embankment with keyed
earth cutoff trench and toe drains parallel
to dam centerline

Length: (ft)	900
Height: (ft)	51
Top Width (ft)	18
Side Slopes: Upstream (V:H)	1:3
Downstream (V:H)	1:2.5

Zone:	None
-------	------

Impervious Core:	None
------------------	------

Cutoff: Compacted earth cutoff trench of
Embankment Material

Grout Curtain:	None
----------------	------

h. Principal Spillway (Taken from Design Report)

Type: 36" outlet pipe from 3 ft x 9 ft I.D. reinforced
concrete riser structure rising 36.93 feet above
the base elevation (outlet invert) 1668.1

Size of Orifice Crest Elevation	1684.2
---------------------------------	--------

Riser Crest Elevation:	1703.2
------------------------	--------

Gates:	Uncontrolled
--------	--------------

i. Auxiliary Spillways

Type: Channel cut into glacial till soils,
trapezoidal cross section, grass lined

Bottom Width (ft):	North Spillway	100
	South Spillway	200
Side Slopes (V:H):		1:3
Length of Level or Control Section (ft):		20
Exit Slope (%)	North	4
	South	6

j. Reservoir Drain

Type: 24" I.D. Bituminous coated corrugated
metal pipe

Length: (ft)	24.5
--------------	------

Control: Manually operated vertical slide gate
mounted on the upstream side of the
Concrete Riser Structure

SECTION 2: ENGINEERING DATA

2.1 GEOTECHNICAL DATA

a. General Geology

The Ischua Creek damsite number 4 is located in the vicinity of the Village of Franklinville, in southwestern New York State; this area is situated at the northern extremity of the Appalachian Plateau physiographic province.

Local bedrock consists of interbedded shales, siltstones and sandstones of the Canadaway and overlying Conneaut Groups which are of upper Devonian age. Although the regional dip of rock units in this province is very gently southward, this dip is so slight that, over relatively small areas, the stratigraphy may be considered essentially horizontal.

Overlying this local bedrock are deposits associated with Pleistocene glaciation of the area. These deposits include glacial till (ground moraine) on uplands and slopes, and outwash deposits (stratified granular material) filling or forming the floor of present or past stream channels.

Although geologic reconnaissance has revealed no major or active faults in this area, the Village of Franklinville is situated in a region classified between Zone 2 and Zone 3 seismicity, as shown on Figure No. 1 of the Recommended Guidelines for Safety Inspection of Dams. We note the Attica, New York area, located roughly 35 miles to the north, has been the site of numerous seismic events of moderate intensity.

b. Subsurface Investigation

NOTE: The following information was extracted from the Design Report prepared by the SCS.

The subsurface investigation conducted by the SCS consisted of a total of 8 test borings and 28 test pit excavations. A total of 2 test borings and 5 test pit excavations were advanced along the dam axis. An additional 3 test pits

were excavated along the principal spillway. Within the two emergency spillways a total of 6 test borings and 12 test pits were advanced. Since additional borrow was needed beyond that within the emergency spillway cut areas 8 more test pit excavations were made in the borrow area.

It should be noted that in the flood plain (which corresponds to the area of maximum embankment height) the 2 test borings advanced penetrated between 15 and 22 feet below the as-built bottom of the cutoff trench.

c. Subsurface Conditions

The overburden soils encountered at this site are composed of alluvial sand and gravel within the flood plain underlain by a dense glacial till at depths ranging from 3 to 9 feet below the former ground surface. Above the flood plain in the valley slopes a thin veneer of topsoil overlays the dense glacial till. The till at this site is a heterogeneous mixture of silt, sand and embedded gravel. The clay fraction is quite low in the range of 5 to 8 percent by weight.

The underlying bedrock is a sandstone with interbedded shale layers as described in the previous section. The bedrock is quite shallow on the north side of the valley and outcrops downstream of the dam in the north abutment. Along the south side of the valley the bedrock was not encountered within the depth of the subsurface investigation which extended to at least 31 feet below the valley floor.

Seeps were detected in the north side of valley during the subsurface investigation and a rusty length of pipe was protruding from one of these seeps exiting from the bedrock. This same condition was found during the visual inspection conducted on May 6, 1980. In fact a rusty length of pipe was found just downstream from abutment-embankment contact.

Clear water was flowing from and around the pipe. This may be the same pipe discussed in the January 1959 Geology Report by the Soil Conservation Service.

2.2 DESIGN RECORDS

The dam was designed by the Soil Conservation Service, who prepared a design report, contract specifications and engineering drawings. Portions of the design folder have been included with this report in Appendix E. In addition a number of as-built drawings prepared by SCS have been included in Appendix F of this report.

2.3 CONSTRUCTION RECORDS

The records of construction were made by SCS and are available from the Syracuse, New York office. Changes from original design are noted on the as-built plans in Appendix F.

2.4 OPERATION RECORDS

The dam was designed as an uncontrolled, floodwater retarding structure and therefore no operating records are maintained regarding reservoir level or spillway discharge. The structure is monitored by SCS personnel and representatives of the Cattaraugus County Watershed District during periods of heavy rainfall.

2.5 EVALUATION OF DATA

The data presented in this report has been compiled from information obtained from the Soil Conservation Service as well as the New York State Department of Environmental Conservation Files.

The available documents reviewed in connection with the Phase I inspection are considered adequate and reliable.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General

The visual inspection of Site 4 Dam was conducted on May 6, 1980. The weather at the time of the inspection was clear with temperatures in the seventies. The reservoir level was at the crest of the orifice, elevation 1684.2.

b. Embankment

The embankment appeared in excellent, well-maintained condition. No evidence of seepage, sloughing, misalignment, cracking or other deleterious conditions was observed. The surface drainage system, which is composed of stone gutters on the downslope side at the abutment-embankment contact, was clean and in good condition.

The internal drainage system is composed of two (2) 8 inch diameter bituminous coated corrugated metal pipes surrounded by "filter" material and extending parallel to the dam centerline providing drainage at the embankment-foundation contact. These pipes outlet parallel to the principle spillway into the plunge pool. There was no discharge from these pipes on the day of the inspection.

c. Principal Spillway

The principal spillway consists of a reinforced concrete riser structure with a 1'0" high by 2'8" wide orifice at elevation 1684.2 and the riser crest at elevation 1703.2. One 36 inch I.D. reinforced concrete pipe bedded on a concrete cradle transports reservoir water from the riser structure to the plunge pool and outlet channel. In general, these components were in satisfactory condition. However, the outlet pipe is cracked at several locations, as shown on the plan contained in a report prepared by SCS and included in Appendix D of this report. The condition of the cracked outlet pipe was first discovered in August 1976 during an inspection by the SCS.

Subsequent to this first inspection, the spillway pipe was reinspected in July 1977, October 1977 and May 1979 and "no apparent change" was noted. Included in Appendix D is a copy of the "Engineering Investigation Report-Ischua Creek Watershed-Site 4" prepared by the Syracuse office of the Soil Conservation Service concerning the cracked principal spillway outlet pipe. This pipe will be drilled and the soil surrounding the pipe grouted in the vicinity of the cracks. Once grouting is completed the cracks will be cleaned and patched with an epoxy cement. This work will reportedly occur during the Summer of 1980. Other deficiencies include the evidence of erosion along south (left) bank of plunge pool and the growth of 1 to 2 inch diameter trees in the outlet channel extending from the downstream edge of the plunge pool a distance of approximately 100 feet. A slight amount of debris was present around the trash rack of the orifice in the riser structure.

d. Auxiliary Spillways

The auxiliary spillways for this structure are located at the north and south ends of the dam, and were in excellent condition at the time of the inspection. The south auxiliary spillway is located in an earth cut whereas the north auxiliary spillway is situated in an earth and rock cut. Both spillways were subsequently lined with topsoil and support a healthy grass cover.

e. Reservoir Drain

The reservoir is drained by a 24 inch I.D. bituminous coated corrugated metal pipe and manually operated slide gate which is attached to the upstream side of the riser structure. The slide gate was reported to be inoperative at the time of the inspection and this condition will be corrected during the Summer of 1980.

f. Downstream Channel

The plunge pool is lined with riprap and a growth of 1 to 2 inch diameter trees lines the downstream channel from the

downstream edge of the plunge pool for a distance of about 100 feet (as previously noted).

g. Reservoir Area

The area surrounding the reservoir is primarily pasture land with gentle slopes. No signs of slope instability were observed.

3.2

EVALUATION

The visual inspection of this dam revealed the following deficiencies:

- 1) Cracks in principal spillway outlet pipe (to be repaired during Summer 1980).
- 2) Reportedly inoperative reservoir drain (to be corrected in Summer 1980).
- 3) Slight amount of debris build up around the orifice trash racks.
- 4) Erosion along the south side of the plunge pool.
- 5) Tree growth in downstream channel 100 feet beyond plunge pool.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURE

4.1 PROCEDURES

The normal reservoir level is controlled by the crest elevation of the orifice in the riser structure. Downstream flows are limited by the flow through the orifice and over the riser crest which discharge 237 cfs when the reservoir is at the crest of the auxiliary spillways.

4.2 MAINTENANCE OF DAM

The dam is maintained by the owner, Cattaraugus County Watershed District. Normal maintenance consists primarily of cutting the grass of the embankment and auxiliary spillways about 2 times a year. Debris is cleared from the trash rack during the summer months.

4.3 WARNING SYSTEM IN EFFECT

There is no warning system in effect, however, the dam is monitored during periods of heavy runoff by representatives of SCS and the owner.

4.4 EVALUATION

The operation and maintenance procedures for this structure are satisfactory.

SECTION 5: HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

Delineation of the watershed draining into the reservoir pool area was accomplished using the USGS 7.5 minute quadrangles for Franklinville, New York. The drainage area measures 4.1 square miles and consists primarily of open fields and woodlands. The topography throughout the drainage area consists of rolling hills with moderate to steep side slopes that range from approximately 5 to 20 percent.

5.2 ANALYSIS CRITERIA

The analysis of the floodwater retarding capability of the dam was performed using the Corps of Engineers HEC-1 computer program, Dam Safety version. This program develops an inflow hydrograph based upon the "Snyder Synthetic Unit Hydrograph" and then utilizes the "Modified Puls" flood routing procedure. The spillway design flood selected for analysis was the PMF in accordance with the recommended guidelines of the U.S. Army Corps of Engineers.

5.3 SPILLWAY CAPACITY

The spillway components of the dam include a principal spillway as well as two auxiliary spillways. The principal spillway consists of a 36" reinforced concrete pipe and a 3' x 9' reinforced concrete riser. For stages above the riser crest, the riser spillway contribution includes the weir flow over the crest of the riser as well as an orifice flow. The orifice measures 2'-8" in width and 1 foot in height and is located at the normal pool elevation of 1684.2 on the side of the riser. Principal spillway discharge is controlled by the orifice and the riser up to the stage of 1706.2. Above this stage the principal spillway discharge is controlled by the 36" diameter outlet pipe. The two auxiliary spillway channels are of trapezoidal sections

with bottom widths of 100 feet and 200 feet and side slopes of 3 horizontal to 1 vertical. Discharge through the auxiliary spillways was calculated at the control section and assumed a weir coefficient of 3.0.

The combined spillways have sufficient capacity for discharging the peak outflow for the Probable Maximum Flood (PMF). For the PMF, the peak inflow is 8,666 cfs and the peak outflow is 8,608 cfs. The computed total spillway capacity for a water surface elevation at the top of dam is 8,650 cfs.

During the PMF storm event the maximum discharge velocity through the auxiliary spillways occurs along the exit slopes and is computed to be 9.99 fps and 11.77 fps for the north and south auxiliary spillways, respectively. In addition, the total duration of auxiliary spillway discharge for the PMF is 21.5 hours.

5.4 RESERVOIR CAPACITY

Storage capacity of the reservoir between the emergency spillway crests and the top of dam is 29 acre-feet, which is equivalent to a runoff depth of 1.32 inches over the drainage area. The normal storage capacity of the dam is 1042 acre-feet with flood storage capacity of the reservoir between the orifice crest and top of the dam of 1011 acre-feet.

5.5 FLOODS OF RECORD

Due to the lack of reliable information, no attempt was made to calculate the discharge for the flood of record.

5.6 OVERTOPPING POTENTIAL

Analysis using the PMF indicates that the dam does have sufficient spillway capacity to discharge the PMF storm event and will not be overtopped.

5.7 EVALUATION

At full PMF, the reservoir surface elevation is 0.05 feet below the top of the dam and the height of water in the auxiliary spillway is 4.15 feet.

The maximum discharge velocities through the auxiliary spillway is in excess of the normally accepted maximum velocity for grass lined spillways of 8 fps. Therefore, there exists the potential for erosion of the spillway channels during heavy runoff.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

No signs of instability were observed in connection with the earth embankment during this inspection. It appears that an unsuitable subgrade condition in connection with improper backfilling methods may have caused the crack development in the principal spillway outlet which is covered by the inspection reports included as Appendix D. The leakage noted during the inspections was clear water and no piping was suspected. However, to insure piping has not occurred the soil surrounding the pipe in the vicinity of the cracks will be grouted.

b. Design and Construction Data

At least two (2) slope stability analyses were performed by SCS for the embankment during the design phase. The soil strength parameters utilized in the analyses were based on consolidated undrained (R) triaxial shear tests. The tests were conducted on remolded proposed embankment materials compacted to at least 95 percent of the maximum dry density attainable through the Standard Proctor Compaction Test (ASTM D-698). The samples were saturated prior to the consolidation phase of the test. The shear strength parameters used in the analyses are as follows:

<u>Sample</u> <u>No.</u>	<u>Internal Friction Angle</u> <u>(degrees)</u>	<u>Cohesion</u> <u>(psf)</u>
62W331	26.5	575

We note the tests were conducted on remolded materials having a gradation less than the No. 4 sieve size.

The method of analysis used was the Swedish slip-circle method. The results of the downstream slope are shown in the design report in Appendix E. The conditions of the failure arc investigated assumed the reservoir level at the auxiliary spillway crest, no toe drainage and the failure arc passing only through the embankment. A factor

of safety of 1.92 was computed for the above conditions, and it was further noted in the design folder a similar factor of safety was determined for the upstream slope under rapid drawdown conditions.

Although the stability analyses were cursory the embankment slopes are of normal configuration for a homogeneous earth embankment composed of recompacted glacial till soils.

Design of the crest width and longitudinal camber for settlement considerations as well as the cutoff trench width and depth are in accordance with standard practice. The design and construction of the internal drainage system is of conventional design for homogeneous earth embankment dams.

c. Erosion Protection

The design documents do not appear to address in-service erosion protection of the auxiliary or spillway channels.

The sodded slopes of the embankment appear to have performed satisfactorily and can be expected to continue to do so.

The case of the auxiliary spillway is somewhat less certain, however. The calculated maximum discharge velocity and duration of flow over the control section are higher than would normally be considered permissible for sodded channels.

d. Seismic Stability

No seismic stability analyses were performed as part of the dam design.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I inspection of the Ischua Creek Watershed Site 4 dam did not reveal conditions which constitute a hazard to human life or property. The earth embankment is considered structurally stable and the spillways are capable of retarding and safely discharging floodwaters resulting from the Probable Maximum Flood (PMF).

b. Adequacy of Information

The information which was reviewed is considered to be adequate for Phase I study purposes with the following reservations:

- o The stability analysis consisted of only two trial failure surfaces, neither of which penetrated the foundation material.
- o The record does not indicate that consideration was given to the potential of erosion during the relatively long duration of flow in the auxiliary spillway.

c. Need for Additional Investigation

It is recommended that the following additional investigation or study be undertaken:

- o An evaluation of the auxiliary spillway erodability and the possible need for additional protection.

d. Urgency

An emergency preparedness plan for notification and evacuation of downstream residents should be developed and implemented within 6 months. The evaluation of the auxiliary spillway erodability and the possible need for additional protection should be undertaken within 6 months and completed within 18 months.

7.2

RECOMMENDED REMEDIAL MEASURES

- a. Repair cracked principal spillway outlet pipe and slide gate mechanism (as has been programmed for Summer 1980).
- b. Provide a procedure for periodic inspections including operation and lubrication of slide gate mechanism.
- c. Remove trees and brush from downstream channel from end of plunge pool downstream to original contact limit.
- d. Regrade outlet channel to original design 8 foot base dimension with (V:H) 1:2 side slopes to match existing ground surface.
- e. Line south side of plunge pool in areas of eroded banks with riprap.
- f. Develop and implement a warning system and evacuation plan for downstream residents and proper authorities in the event of large auxiliary spillway discharge.

APPENDIX A

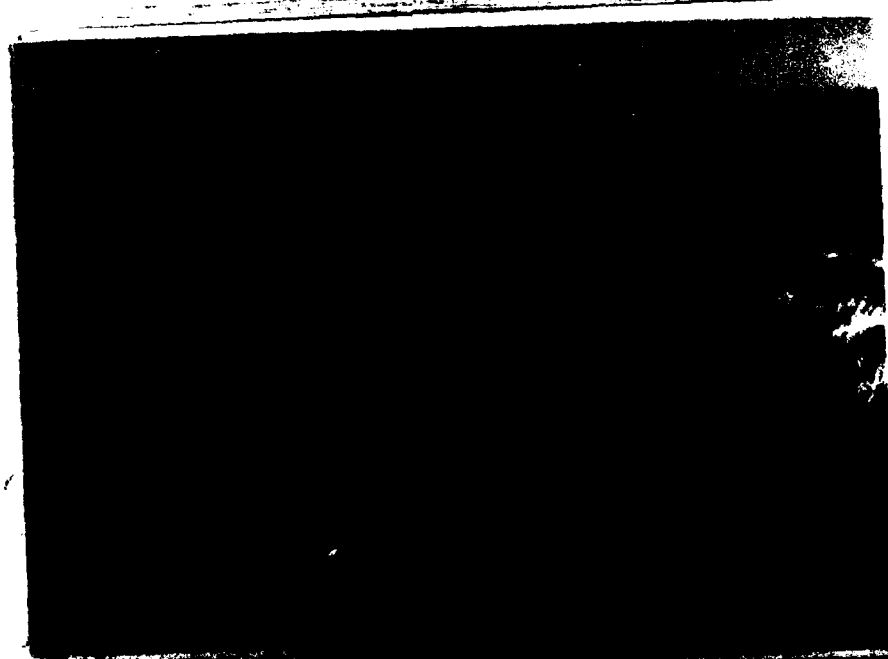
PHOTOGRAPHS



View of upstream slope from
north side of embankment.



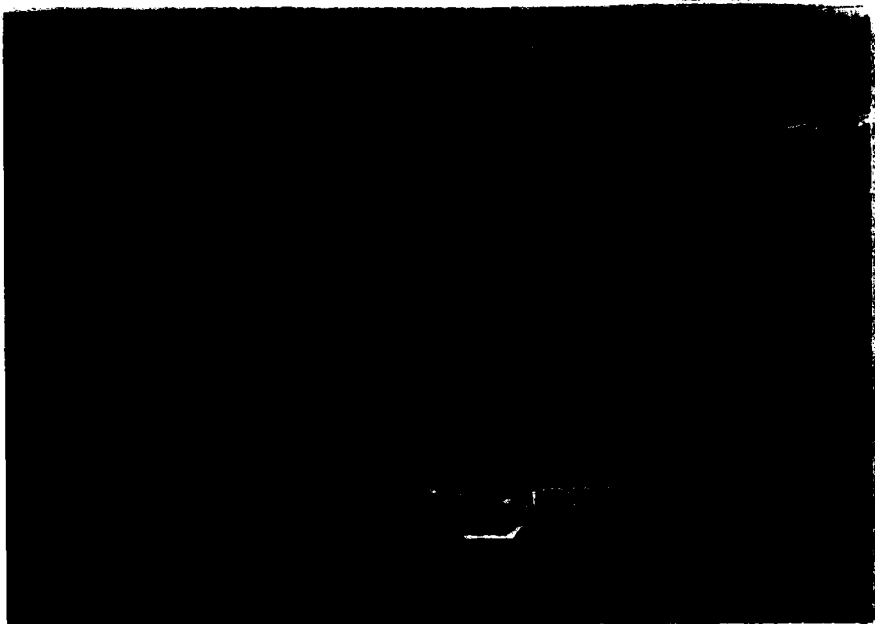
Overview of upstream slope from
north side.



Downstream slope from south
abutment. Note trees growing
in left side of photo at north
abutment and seepage emerging
(see 3rd photo following)



View of downstream slope from
south side of downstream valley.



View showing downstream slope,
outlet pipe, toe drain pipe,
and plunge pool.



Close-up showing seepage from
north abutment near the toe.



View of outlet pipe and plunge pool.



Detailed view of outlet pipe, toe drain pipes, and stone gutter.



View of erosion along south side of pool.

View of south spillway looking
downstream.

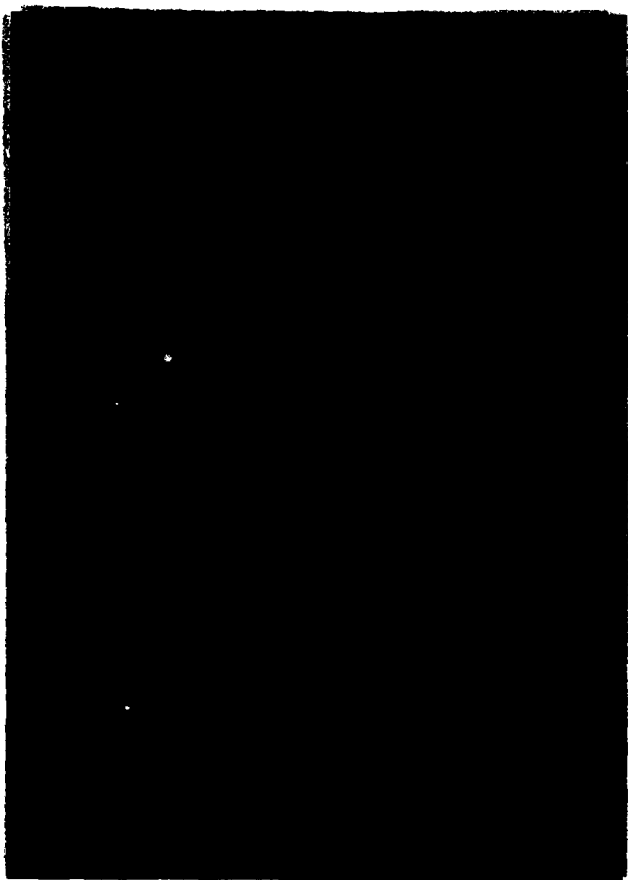


View of north spillway looking
downstream.

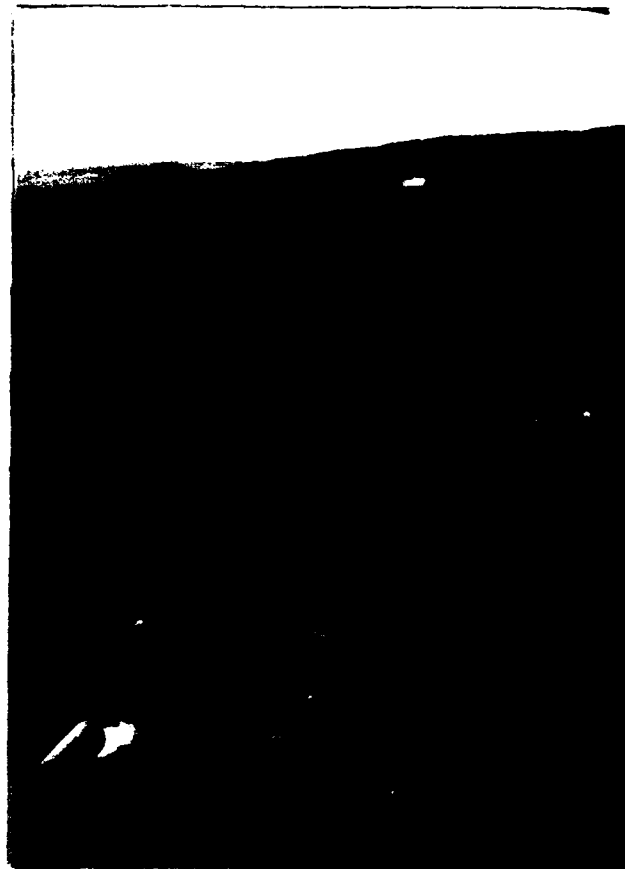


View looking downstream at
first channel obstruction.





View of intake structure
(note debris accumulated on
trash rack, and bullet hole in
concrete).



View of plunge pool and
downstream channel from
crest of dam.

APPENDIX B

VISUAL INSPECTION CHECKLIST

THOMSEN ASSOCIATES
CONSULTING GEOTECHNICAL ENGINEERS & GEOLOGISTS

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam Ischua Creek - Side 4

Fed. I.D. # 25-3060 DEC. Dam No. NY 1626

River Basin Allegheny

Location: Town Franklinville County Cattaraugus

U.S.G.S. Quadrangle Franklinville

Stream Name Saunders Creek

Tributary of Ischua Creek

Latitude (N) 42°20'45" Longitude (W) 78°26'14"

Type of Dam Earth Dam

Hazard Category C High

Date(s) of Inspection 5/6/80

Weather Conditions Clear & Mild

Reservoir Level at Time of Inspection 1684.2 Controlled by orifice on Intake Structure

Tailwater Level at Time of Inspection ≈ 1660.5

b. Inspection Personnel Charles T. Gaynor II - Thomsen Associates

Paul Sprenberg - N&T Harry Hirsch - Dan Lake - SCS

Ed Smith - Cattaraugus County Watershed District

c. Persons Contacted (Including Address & Phone No.)

Dale Clark - SCS local - 716-699-2326

Robin Warrander - DEC - Albany - 518-457-5557

Dan Lake & Harry Hirsch - SCS - Syracuse Office - 315-423-5503

d. History:

Date Constructed 8/62 - 9/63 Date(s) Reconstructed NONE

Designer Soil Conservation Service

Constructed by Sack Bros Inc.

Owner Cattaraugus County Watershed District - O & M

e. Seismic Zone Boundary Zone 2 - Zone 3

(See Algermissen & Mee - Corps of Engineer Guidelines)

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VISUAL INSPECTION CHECKLIST

2) Embankment

a. Characteristics

- 1) Embankment Material Glacial Till - 26-44% of
- #200 sieve size, 5-8% clay size, 6" Max
- 2) Cutoff Type Cutoff Trench
- 3) Impervious Core None - Dam is homogeneous
- 4) Internal Drainage System Drain Trench
Drain Trench with 8" C.I.P.P. Perforated Pipe
- 5) Miscellaneous

b. Crest

- 1) Vertical Alignment Good
- 2) Horizontal Alignment Good
- 3) Surface Cracks None
- 4) Miscellaneous

c. Upstream Slope

- 1) Slope (Estimate) (V:H) 1:3
- 2) Undesirable Growth or Debris, Animal Burrows None
- 3) Sloughing, Subsidence or Depressions None

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VISUAL INSPECTION CHECKLIST

4) Slope Protection Grass Covered

5) Surface Cracks or Movement at Toe NONE

d. Downstream Slope

1) Slope (Estimate - V:H) 1:2.5

2) Undesirable Growth or Debris, Animal Burrows NONE

3) Sloughing, Subsidence or Depressions NONE

4) Surface Cracks or Movement at Toe NONE

5) Seepage Natural Seep Beyond Stone Gutter along
Right Abutment in Natural Slope with pipe from seep
(Note: This seep was described in Leaky Design Report by SCS)

6) External Drainage System (Ditches, Trenches; Blanket)

Stone Gutters along Abutment-Embankment Contact

7) Condition Around Outlet Structure Good

8) Seepage Beyond Toe NONE

e. Abutments-Embankment Contact

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VISUAL INSPECTION CHECKLIST

- 1) Erosion at Contact NONE
- 2) Seepage Along Contract Natural Seep see notes
on Downstream Slope
- 3) Drainage System
- a. Description of System Intersect toe drain trench to
drain trench & 8" ϕ perforated CMP parallel to
Dam & (88' from Dam &)
- b. Condition of System unobservable
- c. Discharge from Drainage System NONE
- 4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)
- South End Elev. 1712.22 STA. 0+00 on DAM &
- North End Elev. 1756.19 STA. 15+05 on Dam &

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VISUAL INSPECTION CHECKLIST

5) Reservoir

- a. Slopes Right Side (D. H.) 13.5 5-10°
Left Side 1:2
- b. Sedimentation Unobservable
- c. Unusual Conditions Which Affect Dam None

6) Area Downstream of Dam

- a. Downstream Hazard (No. of Homes, Highways, etc.)
Bridge located at intersection of Downstream Channel & Hardy Coenra Rd.
- b. Seepage, Unusual Growth Natural Seepage along
Former Shon Channel
- c. Evidence of Movement Beyond Toe of Dam None
- d. Condition of Downstream Channel Plunge Pool some evidence of
erosion along left side (See Photo) Beyond Plunge Pool
Channel is free lined 1-2" & for approx 100'

7) Spillway(s) (Including Discharge Conveyance Channel)

Concrete Riser Inlet Structure with orifice control
for Normal Pool & 1-36" I.D. R.C. Outlet Pipe

- a. General Orifice @ Elevation - 1684.2
Riser Crest @ Elevation - 1703.2
Entrance Elevation 1668.1 (at Riser) Exit Elevation 1662.5
- b. Condition of Service Spillway Good yet Gate Stem is
Unrepairable, 36" I.D. R.C. Pipe is cracked
at several locations (See Report by SCS &
As built drawings)

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VISUAL INSPECTION CHECKLIST

c. Condition of Auxiliary Spillway Good - Grass Lined Channel
Design Max. Spillway Elevation 1713.0 (Both North &
South Sides)

d. Condition of Discharge Conveyance Channel Slight Erosion on
South Side of Plunge Pool, Trees (1-2" ϕ) in
and on Channel Bank from end of Plunge Pool
downstream \approx 100'

8) Reservoir Drain/~~Outlet~~

Type: Pipe ☒ Conduit _____ Other _____

Material: Concrete _____ Metal ☒ B.C.C.M. Other _____

Size: 24" I.D. Length 24.5'

Invert Elevations: Entrance 1669.5 Exit 1668.6 (in River Structure)

Physical Condition (Describe): _____ Unobservable ☒

Material: _____

Joints: _____ Alignment _____

Structural Integrity: _____

Hydraulic Capability: _____

Means of Control: Gate ☒ Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable ☒ Other _____

Present Condition (Describe): Condition of Inoperable
Gate to be further investigated and corrected by
Cattaraugus County Watershed District within the month

Notes - No Warning System or Evacuation Plan

- Yearly Inspection by SCS & Cattaraugus Co. Watershed Dist.

- During Major Storms Inspection by SCS & Cattaraugus Co.
Watershed Dist.

- Ed Smith indicated reservoir level has passed over
river crest @ Elev. 1703.2 (Normal Pool
- 1684.2)

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9) Structural

a. Concrete Surfaces Good - Risar Intake Structure
Several Bullet Holes with 1/2 to 3/4"
pneumatation

b. Structural Cracking Cracks in Spillway Outlet Pipe
See As built Drawings & Report by S&S

c. Movement - Horizontal & Vertical Alignment (Settlement)
NONE

d. Junctions with Abutments or Embankments

e. Drains - Foundation, Joint, Face

f. Water Passages, Conduits, Sluices

g. Seepage or Leakage

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- h. Joints - Construction, etc. Tight
- i. Foundation
- j. Abutments
- k. Control Gates Reservoir Drain Inoperable to be repaired
Summer 1980
- l. Approach & Outlet Channels
- m. Energy Dissipators (Plunge Pool, etc.)
- n. Intake Structures Concrete Rise Intake Structure
- o. Stability
- p. Miscellaneous

APPENDIX C

HYDROLOGIC/HYDRAULIC ENGINEERING
DATA AND COMPUTATIONS

THOMSEN ASSOCIATES

CONSULTING ENGINEERS AND ARCHITECTS

CHECK LIST FOR DAMS HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

AREA-CAPACITY DATA:

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (acre-ft.)
1) Top of Dam	<u>1717.2</u>	<u>32.2</u>	<u>1042</u>
2) Design High Water (Max.Design Pool)	<u>1715.9</u>	<u>73.0</u>	<u>943</u>
3) Auxiliary Spillway Crest	<u>1713.0</u>	<u>59.0</u>	<u>735</u>
4) Pool Level with Flashboards	<u>N.A.</u>	<u>N.A.</u>	<u>N.A.</u>
5) Service Spillway Crest	<u>1703.2</u>	<u>26.2</u>	<u>323</u>
6) Orifice Crest	<u>1684.2</u>	<u>5.6</u>	<u>31</u>

DISCHARGES

	<u>Volume</u> (cfs)
1) Average Daily	<u>Unknown</u>
2) Spillway @ Maximum High Water (TOP OF DAM)	<u>247</u>
3) Spillway @ Design High Water (Elev. 1715.9)	<u>243</u>
4) Spillway @ Auxiliary Spillway Crest Elevation	<u>237</u>
5) Low Level Outlet	<u>70</u>
6) Total (of all facilities) @ Maximum High Water	<u>3150</u>
7) Maximum Known Flood	<u>Unknown</u>

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CONSULTING ENGINEERS AND ARCHITECTS

OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES:

Type: Gate ☒ Sluice ☐ Conduit ☐ Penstock ☐
Shape: Circular
Size: 24" I.D.
Elevations: Entrance Invert 1662.5
Exit Invert 1668.6
Tailrace Channel: Elevation No Application

HYDROMETEROLOGICAL GAGES:

Type: None
Location: _____
Records:
Date - _____
Max. Reading - _____

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

Reservoir Pools with manually controlled
slide gate

THOMSEN ASSOCIATES

CONSULTING CIVIL AND MECHANICAL ENGINEERS • 1000 17th St. N.W. • Washington, D.C. 20036 • (202) 462-1100

CREST:

ELEVATION: 1711.2

Type: Homogeneous Earth Embankment

Width: 18 feet Length: 900 feet

Spillover: Concrete Riser Structure

Location: Near Maximum Section of Dam Upstream Embankment

SPILLWAY:

PRINCIPAL

EMERGENCY

Profile - 1684.2

Riser Crest - 1703.2

Elevation 1712.0

Top

Type Trapezoidal Grass Lined Channel

Width SOUTH - 200'

NORTH - 100'

Type of Control

Yes

Uncontrolled

Yes

Controlled:

Type

(Flashboards; gate)

Number

Size/Length

Invert Material

Grass lined over topsoil underlain by

Anticipated Length
of operating service

21.5 hours @ 7ME

Chute Length

Not Applicable

Height Between Spillway Crest
& Approach Channel Invert
(Weir Flow)

2% Entrance
Slope

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DRAINAGE AREA: 4.1 sq miles

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Parkland

Terrain - Relief: 5 to 20 percent

Surface - Soil: Heterogeneous Mixture of SA, Sand & Silt

Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

No Changes Planned

Potential Sedimentation problem areas (natural or man-made; present or future)

Natural Pool is designed as a 50 year
Sediment Pool

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

Approximately 1000 ft. of Hardy Road would be
inundated with a maximum water depth of
about 10 feet during the PMF.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: NONE

Elevation: _____

Drainage Area = 4.1 sq. mile

Estimation of Lag time (t_p)

$$t_p = C_t (.955)(L \cdot L_c)^{.3} + .25 L R = 1.85 \times .955 (3.78 \times 1.32)^{.3} + .25 (.5) \\ = 2.99 \text{ hr.}$$

$$\text{slope of the basin} = \frac{1960 - 1720}{12000} \times 100 = 2\%$$

Check of Lag Time

Using Linsley, Kohler & Paulhus equation

$$\text{Lag } (t_p) = 0.72 \left(\frac{L \cdot L_c}{\sqrt{S}} \right)^{.38} \\ = .72 \left(\frac{3.78 \times 1.32}{\sqrt{.02}} \right)^{.38} = 2.79 \text{ hr.}$$

In HEC-1 input $t_p = 3.0$ & $C_p = .63$ were used to develop Snyder's unit hydrograph

Probable Maximum Precipitation

From Hydrometeorological Report #33, Probable Maximum Precipitation = 22.5 inches (For 200 sq. mile - 24 hour duration)

Depth-Area-Duration Relationship (Zone 2)

6 hour - 116%

12 hour - 127%

24 hour - 141%

McFarland-Johnson Engineers, Inc.
171 Front Street
BINGHAMTON, NEW YORK 13905

JOB HYDROLOGIC STUDY DAM # N 626
SHEET NO. _____ OF _____
CALCULATED BY P.S. DATE 6/2/80
CHECKED BY _____ DATE _____
SCALE _____

STAGE - STORAGE DATA

Elevation (ft.)	Surface Area (Acres)	Avg. Area (Acres)	INCREMENTAL STORAGE (Acree ft)	Total Storage (Acree ft)	Remarks
1684.2	5.6		0	0	Surface Areas are directly taken from S.C.S. design report since they are computed with maps of 2 foot and 5 foot contour intervals.
1703.2	26.2	15.9	302	302	
1713.0	59.2	42.7	418	720	
1715.9	73.0	66.1	192	912	
1717.2	80.0	76.5	99	1011	
1718.2	98.0	89.0	89.0	1100	

NOTE: Storage for other stages for HEC-1 input were
interpolated from stage-storage curve.

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BINGHAMTON, NEW YORK 13905

JOB _____

SHEET NO. _____

OF _____

CALCULATED BY _____

P.S.

DATE _____

6-1-50

CHECKED BY _____

DATE _____

SCALE _____

STAGE-DISCHARGE COMPUTATION

Normal Pool Elevation - 1684.2
Elevation of Crest of Riser - 1703.2
Emergency Spillway Elevn. - 1713.0
Elevation of top of dam - 1717.2
Elevation of Tailwater - 1660.5

Size of Orifice - 2' 8" x 1'
Size of Outlet Pipe - 36" ϕ , $S_o = .021$
Length of Pipe - 266.3', $n = .012$
Elev. @ Inlet of Pipe - 1668.1
Riser Opening - 9' x 1'-2" (2)

Assumptions:

- ① A constant coefficient of discharge of 0.7 was assumed to compute discharge through orifice.
- ② To compute the discharge through the riser, Weir flow equation was used for the reservoir stage below the top of riser. For all reservoir stage above the top of riser orifice flow equation was used.
- ③ Coefficient of Weir = 3.0
- ④ Bureau of Public Roads Hydraulic Engineering Circular #5 was used to compute headwater assuming inlet & outlet control. Long hand calculations were made to compute headwater beyond the limit of the chart.
- ⑤ In computing discharge through emergency spillways, all velocity and friction loss were ignored.
- ⑥ Tailwater Elevation was ignored since the outlet pipe is discharging into a plunge pool.

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BINGHAMTON, NEW YORK 13905

JOB _____
SHEET NO _____ OF _____
CALCULATED BY P.S. DATE 6/3/66
CHECKED BY _____ DATE _____
SCALE _____

STAGE - DISCHARGE COMPUTATIONS (CONT.)

ELEV.	STAGE	Orifice	Inlet Control		Outlet Control			Control	Riser & Pipe		Emerg. Spillway	TOTAL
		Discharge	HW/D	HW	det'd	H	HW	HW	H	DISCHARGE	DISCHARGE	
ft.	ft.	C.F.S.		ft.	ft.	ft.	ft.	ft.	ft.	C.F.S.	C.F.S.	C.F.S.
1684.2	0											0
1686.2	2	18	-	-	2.2	.25	-	-				18
1688.2	4	28	-	-	2.37	.70	-	-				28
1690.2	6	35	1	3	2.40	1.10	-	3				35
1692.2	8	41	1.12	3.4	2.52	1.50	-	3.4				41
1694.2	10	46	1.22	3.7	2.60	1.88	-	3.7				46
1696.2	12	51	1.36	4.1	2.65	2.25	-	4.1				51
1698.2	14	55	1.48	4.4	2.70	2.70	-	4.4				55
1700.2	16	59	1.60	4.8	2.75	3.05	.20	4.8				59
1702.2	18	62	1.70	5.1	2.77	3.30	.47	5.1				62
1704.2	20	66	4.6	13.8	3.0	13.0	10.4	13.8	1.0	54	-	120
1706.2	22	27	-	28.0	3.0	37.4	34.8	34.8		182	-	210
1708.2	24	-	-	-	3.0	42.7	40.1	40.1	40.1	224	-	224
1710.2	26	-	-	-	3.0	44.7	42.1	42.1	42.1	230	-	230
1712.2	28	-	-	-	3.0	46.7	44.1	44.1	44.1	235	-	235
1714.2	30	-	-	-	3.0	48.7	46.1	46.1	46.1	240	1200	1440

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 BINGHAMTON, NEW YORK 13905

JOB WATER MAIN SHEET # 10
 SHEET NO. _____ OF _____
 CALCULATED BY P.S. DATE 8/3/78
 CHECKED BY _____ DATE _____
 SCALE _____

STAGE-DISCHARGE COMPUTATIONS (CONTD.)

ELEV.	STAGE	Orifice	Inlet Control		Outlet Control			Control	Riser & Pipe		Emerg. Spillway	Discharge over top of dam	Total
		Discharge	HW/L	HW	$\frac{d_1+d_2}{2}$	H	HW	HW	H	Discharge	Discharge		Discharge
ft.	ft.	c.f.s.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	c.f.s.	c.f.s.	c.f.s.	c.f.s.
1716.2	32	-	-	-	3.0	50.7	48.1	48.1	48.1	245	5400	-	5645
1717.2	35	-	-	-	3.0	51.7	49.1	49.1	49.1	247	8400	-	8650
1718.2	36	-	-	-	3.0	52.7	50.1	50.1	50.1	249	11700	1905	13605

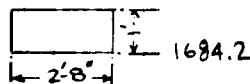
SAMPLE CALCULATIONS

ORIFICE DISCHARGE

STAGE @ 1690.2, $Q = CA\sqrt{2gH}$

$C = 0.7$, $A = 2.66 \times 1 = 2.66 \text{ ft}^2$ $H = 1690.2 - 1684.7 = 13.5$

$Q = .7 \times 2.66 \times \sqrt{64.4 \times 13.5} = 55 \text{ c.f.s.}$

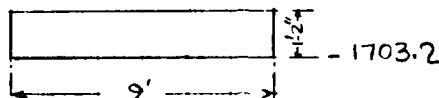


RISER DISCHARGE

STAGE @ 1706.2 $Q = CA\sqrt{2gH}$

$C = 0.7$, $A = 2 \times 9 \times 1.16 = 20.88 \text{ ft}^2$

$H = 1706.2 - 1703.8 = 2.4'$



$Q = .7 \times 20.88 \times \sqrt{64.4 \times 2.4} = 182 \text{ c.f.s.}$

Computed Head with $Q = 182 \text{ c.f.s.}$ indicates that the orifice will be submerged. Therefore, orifice discharge will be greatly reduced. By trial and error the total combined discharge through orifice and riser was computed. Total discharge of 210 c.f.s. was assumed and with this discharge HW (inlet & outlet control) were computed.

Controlling HW (outlet control) = 34.8

Water Surface El. in the riser box = $1668.1 + 34.8 = 1702.9 > 1685.2$

ΔH for Orifice = $1706.2 - 1702.9 = 3.3'$

Discharge thru Orifice = $CA\sqrt{2gH} = .7 \times 2.66 \sqrt{64.4 \times 3.3} = 27 \text{ c.f.s.}$

Total Discharge = $182 + 27 = 209 \text{ c.f.s.} = 210 \text{ c.f.s.}$

PIPE CONTROL

At stage of 1709.2, the computed headwater with combined discharge was more than the stage elevation. Therefore, it was assumed pipe controls and it is outlet control.

$HW = 1709.2 - 1668.1 = 40.1$

$HW = H_{tho} - L_{so}$ $\therefore H = 40.1 - 3.0 + 5.6 = 42.7$

$$H = \left(1 + K_e + \frac{29 n^2 L}{R^{4/3}} \right) V^2 / 2g$$

$$42.7 = \left(1 + 1 + \frac{29 (0.012)^2 \times 266.3}{(75)^{4/3}} \right) V^2 / 2g$$

$$42.7 = 2.73 V^2 / 2g \quad V = 31.73 \text{ ft/sec}$$

$$\therefore Q = A \times V = 7.068 \times 31.73 = 224 \text{ c.f.s.}$$

EMERGENCY SPILLWAY

Stage @ 1716.2

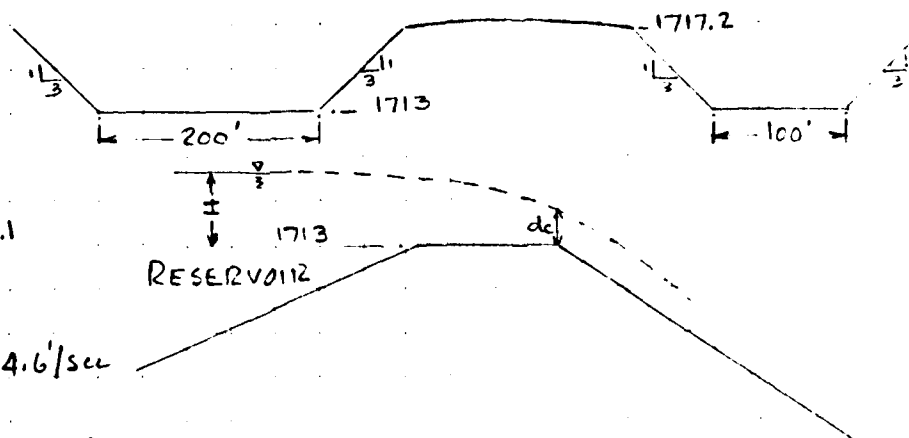
Q thru Pipe,

$$HW = 1716.2 - 1668.1 = 48.1$$

$$H = 48.1 - 3 + 5.6 = 50.7$$

$$50.7 = 2.73 V^2 / 2g, V = 34.6 \text{ ft/sec}$$

$$Q = 7.068 \times 34.6 = 245 \text{ c.f.s.}$$



Discharge thru Emergency spillways,

$$H = 1716.2 - 1713 = 3.2'$$

Neglecting approach velocity & friction loss, $H = dc + V_c^2 / 2g$

Computations involve assuming a discharge thru each spillway and calculate dc and $V_c^2 / 2g$ to balance two sides of the equation. Table 8-5 of King & Brater "Handbook of Hydraulics" was used to compute dc .

Thru 100' wide trapezoidal channel, $Q = 1800 \text{ c.f.s.}$, $K_c = 0.08$, $dc/k = 0.021$

$$dc = 2.1, V_c = 1800 / 223.2 = 8.06 \text{ ft/sec}, V_c^2 / 2g = 1.0 \therefore dc + V_c^2 / 2g = 3.1 \approx 3.2'$$

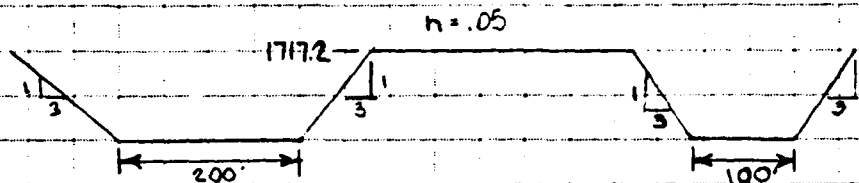
Thru 200' wide trapezoidal channel computed $Q = 3600 \text{ c.f.s.}$

$$\therefore \text{Total Discharge} = 1800 + 3600 + 245 = 5645 \text{ c.f.s.}$$

Auxiliary Spillways

Downstream Slope = 6%
(South)

Downstream Slope = 4%
(North)



Maximum Discharge thru emergency spillway = 8,400 cfs @ 1717.2

$Q = 5600$ cfs thru 200' bw trapezoidal section

$Q = 2800$ cfs thru 100' bw " "

Using Table 7-11 pp 7-38 of King & Brater "Handbook of Hydraulics"

$$K' = \frac{5600 \times .055}{(200)^{3/2} \times (.06)^{1/2}}$$

$$K' = \frac{2800 \times .055}{(100)^{3/2} \times (.04)^{1/2}} = .00357$$

$$d/b = .0115$$

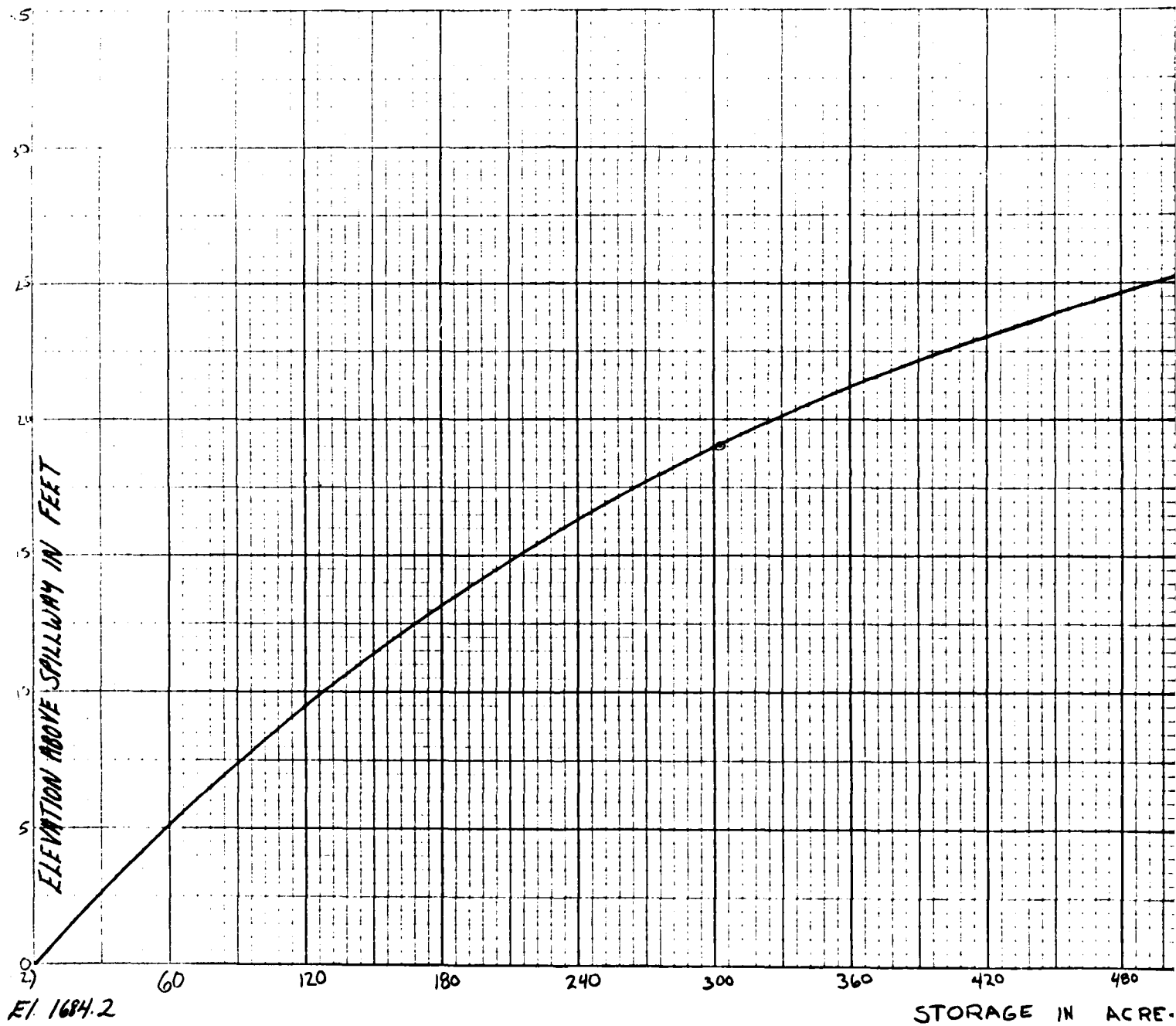
$$d/b = .026$$

$$d = .0115(200) = 2.3'$$

$$d = .026(100) = 2.6$$

$$V = 5600 / 475.9 = 11.77' / \text{sec}$$

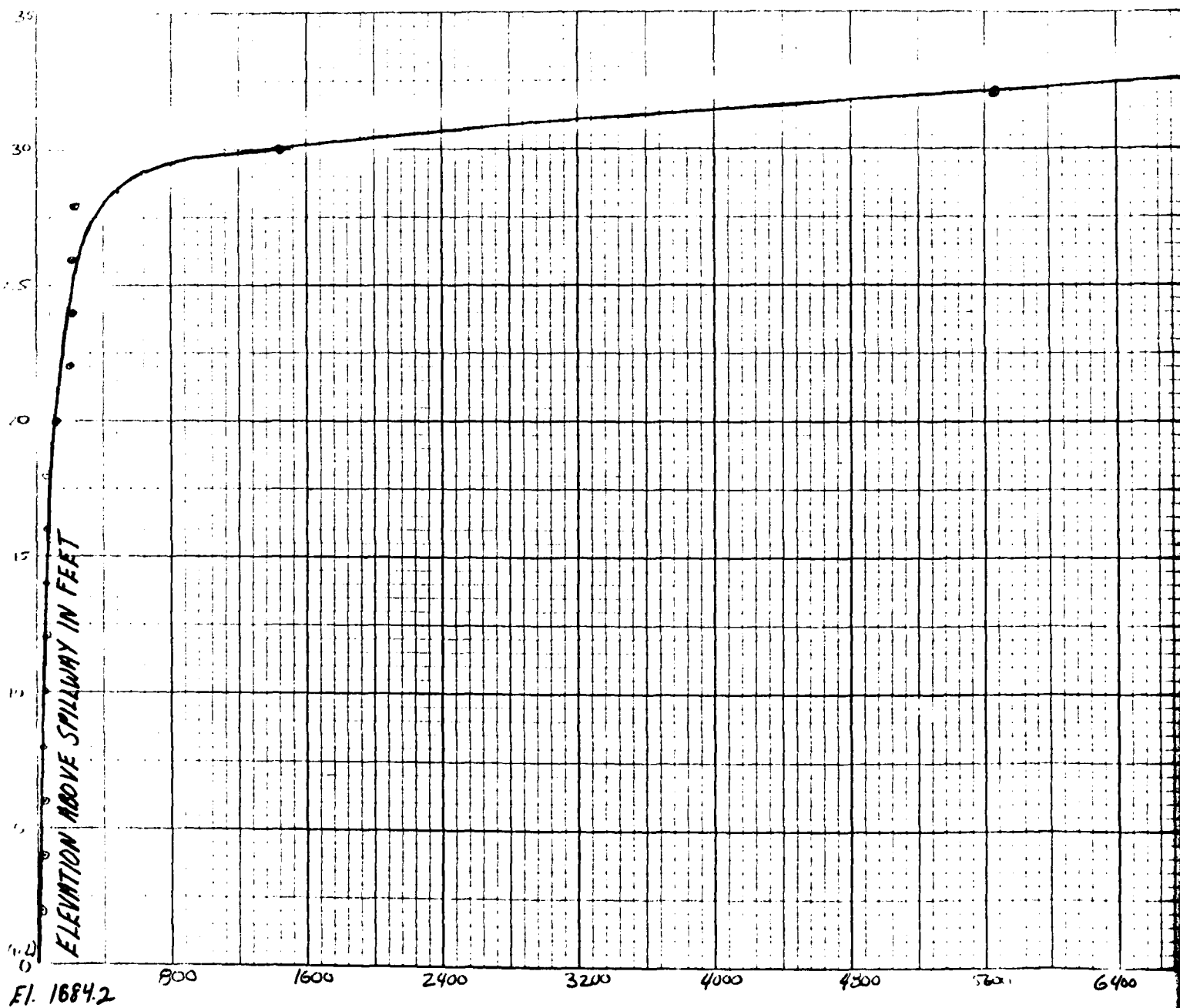
$$V = 2800 / 282.3 = 9.99' / \text{sec}$$



El. 1684.2

46 0782

1:2 10 X 10 TO THE INCH • 7 X 10 INCHES
KUPFER & ESSER CO. MADE IN U.S.A.



FI. 1684.2

46 0782

DISCHARGE IN CFS

10 X 10 TO THE INCH • 7 X 10 INCHES
REUPREX A. ENCL. CO. MADE IN U.S.A.

K.E.

4

7200

8000

8800

9600

10400

11200

12000

CFS

73440
OL OL X

天・地

46 0782

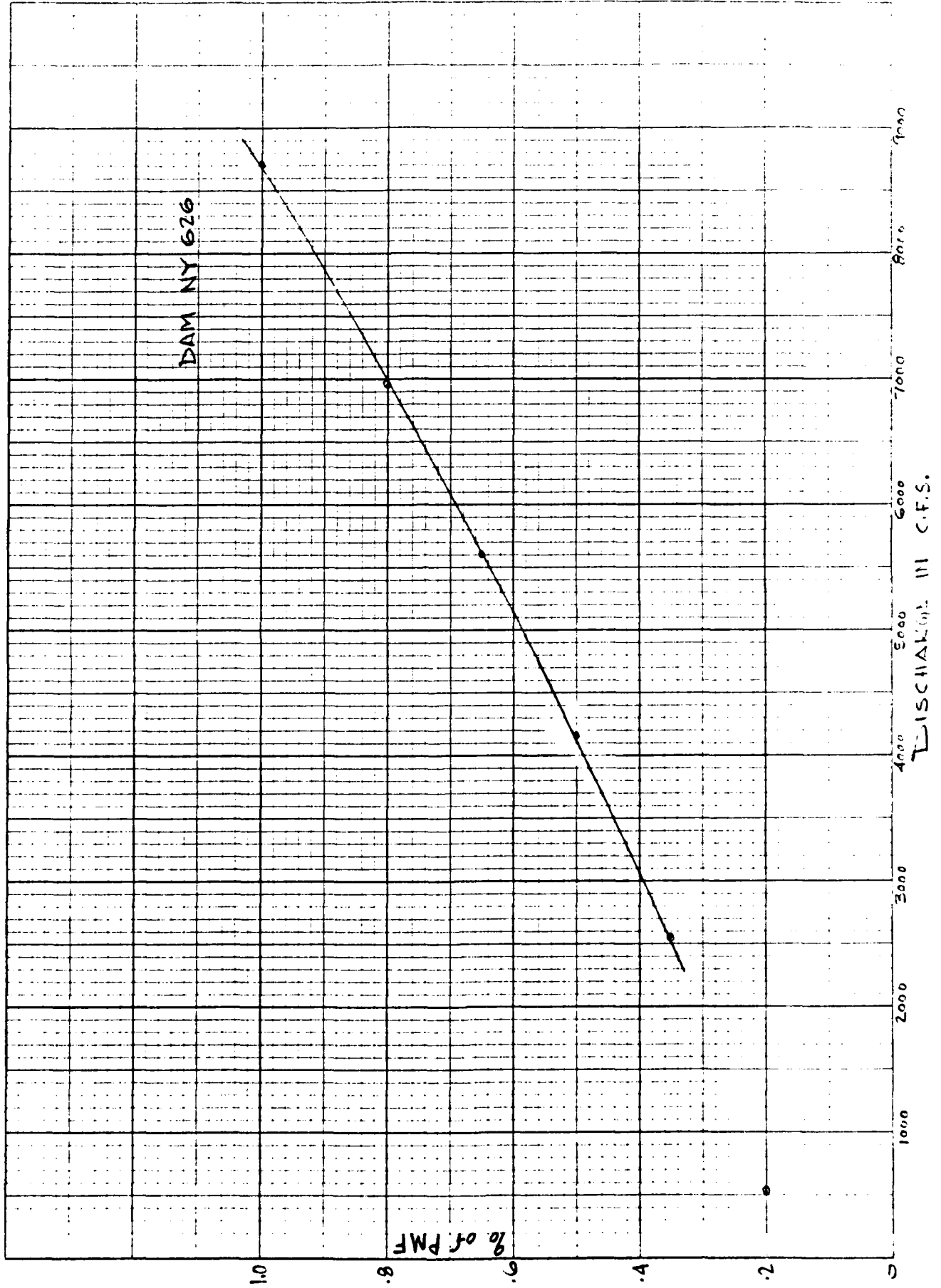
2

STAGE DISCHARGE CURVE
DAM # NY626

9600 10400 11200 12000 12800 13600 14400 15200

46 0782

K&E
10 X 10 TO THE INCH • 7 X 10 INCHES
NEUFEL & ESSEN CO. MADE IN U.S.A.



 FLOOD HYDROGRAPH PACKAGE (FHC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 20 FEB 79

1	A1	ANALYSIS OF DAM OVERTOPPING USING RATIOS						
2	A2	HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF						
3	A3	RATIOS OF PAF ROUTED THROUGH THE RESERVOIR						
4	E	100	0	30	0	0	0	0
5	B1	5						
6	J	1	0	1				
7	J1	.2	.35	.5	.65	.8	1	
8	R	0	1	0	0	0	0	1
9	K1	CALCULATION OF INFLOW HYDROGRAPH						
10	M	1	1	4.1	0	4.1	0	0
11	F	0	22.5	110	127	141	0	0
12	T	0	0	0	0	0	0	1
13	W	3.00	.025					
14	X	-2	-.1	2				
15	K	1	2	0	0	0	0	1
16	K1	ROUTING OF INFLOW HYDROGRAPH						
17	Y	0	0	0	1	1		
18	Y1	1	0	0	0	0	0	-1
19	Y2	0	50	100	175	340	415	690
20	12	1100						
21	Y3	0	35	40	55	120	210	235
22	Y3	13855						
23	R	99						

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF N.Y.626
 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

0	30	0	0	0	0	0	0	0
6	1							
5	.5	.65	.5	1				
1	0	0	0	0	1	0	0	0
TION OF INFLOW HYDROGRAPH								
1	4.1	0	4.1	0	0	0	0	0
5	110	127	141	0	0	0	0	0
0	0	0	0	0	1	.1	0	0
5								
1	2							
2	0	0	0	0	1	0	0	0
OF INFLOW HYDROGRAPH								
0	0	1	1					
0	0	0	0	0	-1			
0	100	175	340	415	690	800	935	1010
5	40	55	120	210	235	1440	5645	8650

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	2
END OF NETWORK	

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

TIME OF EXECUTION 15-JUL-80 10:03:54

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF N.Y.626
 RATIOS OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION									
NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	II	
100	0	30	0	0	0	0	0		
			JUPER	NW1	LROPI	IRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRTIO= 6 LR110= 1
 RTIOS= 0.20 0.35 0.50 0.65 0.80 1.00

SUB-AREA RUNOFF COMPUTATION

CALCULATION OF INFLOW HYDROGRAPH

ISFAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAI
1	0	0	0	0	0	

HYDROGRAPH DATA							
IHYDG	IUNG	TAREA	SNAP	IRSDA	IRSPC	RATIO	ISNOW
1	1	4.10	0.00	4.10	0.00	0.000	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72
0.00	22.50	116.00	127.00	141.00	0.00	0.00

IRSPC COMPUTED BY THE PROGRAM IS 0.800

LOSS DATA

LROPI	SIRKR	DLIKR	RTIOL	ERAIN	STRKS	RTIOK	STRIL	CNSTL
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.10

UNIT HYDROGRAPH DATA

TP= 3.00 CP=0.63 N1A= 0

RECESSION DATA

STRIO= -2.00 URCSN= -0.10 RTIOK= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND IP ARE IC= 0.80 AND R= 5.37 11

UNIT HYDROGRAPH 33 END-OF-PERIOD ORDINATES, LAG= 2.99 HOURS, CP=

35.	130.	257.	392.	501.	559.	554.
276.	231.	192.	155.	132.	109.	91.
43.	36.	30.	25.	20.	17.	14.
7.	6.	5.				

PING USING RATIOS OF PMF
 SIS OF SAFETY OF N.Y.626
 THROUGH THE RESERVOIR

IFICATION
 IMIN METRC IPLT IPRT NSTAN
 0 0 0 0 0
 LRUPI IRACE
 0 0

ES TO BE PERFORMED
 IO= 6 LR110= 1
 0.80 1.00

FF COMPUTATION

TAPE JPLT JPRT INAME ISTAGE IAUTO
 0 0 0 1 0 0

APH DATA
 TRSPC RATIO ISNOW ISAME LOCAL
 0.00 0.000 0 0 0

DATA
 R24 R48 R72 R96
 141.00 0.00 0.00 0.00

DATA
 KS RTIOK STRIL CNSTL ALSMX RTIMP
 00 1.00 1.00 0.10 0.00 0.00

OGRAPH DATA
 =0.63 N1A= 0

ON DATA
 = -0.10 RTIOK= 2.00
 ARE IC= 6.86 AND R= 5.37 INTERVALS

ES, LAG= 2.99 HOURS, CP= 0.63 VOL= 1.00
 559. 554. 488. 404. 336.
 109. 91. 75. 62. 52.
 17. 14. 12. 10. 8.

U		END-OF-PERIOD FLOW					PERIOD		
MO.DA	HR.MN	PERIOD	RATE	EXCS	DUSS	CONF G	MO.DA	HR.MN	PERIOD
1.01	0.30	1	0.00	0.00	0.00	8.	1.02	1.30	5
1.01	1.00	2	0.00	0.00	0.00	7.	1.02	2.00	5
1.01	1.30	3	0.00	0.00	0.00	7.	1.02	2.30	5
1.01	2.00	4	0.00	0.00	0.00	6.	1.02	3.00	5
1.01	2.30	5	0.00	0.00	0.00	6.	1.02	3.30	5
1.01	3.00	6	0.00	0.00	0.00	5.	1.02	4.00	5
1.01	3.30	7	0.00	0.00	0.00	5.	1.02	4.30	5
1.01	4.00	8	0.00	0.00	0.00	5.	1.02	5.00	5
1.01	4.30	9	0.00	0.00	0.00	4.	1.02	5.30	5
1.01	5.00	10	0.00	0.00	0.00	4.	1.02	6.00	6
1.01	5.30	11	0.00	0.00	0.00	4.	1.02	6.30	6
1.01	6.00	12	0.00	0.00	0.00	4.	1.02	7.00	6
1.01	6.30	13	0.17	0.12	0.05	8.	1.02	7.30	6
1.01	7.00	14	0.17	0.12	0.05	23.	1.02	8.00	6
1.01	7.30	15	0.17	0.12	0.05	53.	1.02	8.30	6
1.01	8.00	16	0.17	0.12	0.05	98.	1.02	9.00	6
1.01	8.30	17	0.17	0.12	0.05	156.	1.02	9.30	6
1.01	9.00	18	0.17	0.12	0.05	220.	1.02	10.00	6
1.01	9.30	19	0.17	0.12	0.05	283.	1.02	10.30	6
1.01	10.00	20	0.17	0.12	0.05	339.	1.02	11.00	7
1.01	10.30	21	0.17	0.12	0.05	385.	1.02	11.30	7
1.01	11.00	22	0.17	0.12	0.05	423.	1.02	12.00	7
1.01	11.30	23	0.17	0.12	0.05	455.	1.02	12.30	7
1.01	12.00	24	0.17	0.12	0.05	481.	1.02	13.00	7
1.01	12.30	25	1.04	0.99	0.05	534.	1.02	13.30	7
1.01	13.00	26	1.04	0.99	0.05	666.	1.02	14.00	7
1.01	13.30	27	1.25	1.20	0.05	914.	1.02	14.30	7
1.01	14.00	28	1.25	1.20	0.05	1298.	1.02	15.00	7
1.01	14.30	29	1.57	1.52	0.05	1814.	1.02	15.30	7
1.01	15.00	30	1.57	1.52	0.05	2436.	1.02	16.00	8
1.01	15.30	31	1.90	1.85	0.05	3127.	1.02	16.30	8
1.01	16.00	32	0.03	0.00	0.05	3991.	1.02	17.00	8
1.01	16.30	33	1.40	1.41	0.05	5085.	1.02	17.30	8
1.01	17.00	34	1.40	1.41	0.05	6259.	1.02	18.00	8
1.01	17.30	35	1.15	1.10	0.05	7367.	1.02	18.30	8
1.01	18.00	36	1.15	1.10	0.05	8223.	1.02	19.00	8
1.01	18.30	37	0.13	0.00	0.05	8660.	1.02	19.30	8
1.01	19.00	38	0.13	0.00	0.05	8800.	1.02	20.00	8
1.01	19.30	39	0.13	0.00	0.05	8044.	1.02	20.30	9
1.01	20.00	40	0.13	0.00	0.05	7227.	1.02	21.00	9
1.01	20.30	41	0.13	0.00	0.05	6340.	1.02	21.30	9
1.01	21.00	42	0.13	0.00	0.05	5449.	1.02	22.00	9
1.01	21.30	43	0.13	0.00	0.05	4617.	1.02	22.30	9
1.01	22.00	44	0.13	0.00	0.05	3899.	1.02	23.00	9
1.01	22.30	45	0.13	0.00	0.05	3303.	1.02	23.30	9
1.01	23.00	46	0.13	0.00	0.05	2808.	1.03	0.00	9
1.01	23.30	47	0.13	0.00	0.05	2398.	1.03	0.30	9
1.02	0.00	48	0.13	0.00	0.05	2057.	1.03	1.00	9
1.02	0.30	49	0.00	0.00	0.00	1772.	1.03	1.30	10
1.02	1.00	50	0.00	0.00	0.00	1528.	1.03	2.00	10

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL
CPS	3000.	6652.	2535.	1268.	1
CMS	245.	183.	72.	30.	
InCMS		15.09	23.01	23.98	

END-OF-PERIOD FLOW

LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
0.08	8.	1.02	1.30	51	0.00	0.00	0.00	1314.
0.08	7.	1.02	2.00	52	0.00	0.00	0.00	1123.
0.08	7.	1.02	2.30	53	0.00	0.00	0.00	951.
0.08	6.	1.02	3.00	54	0.00	0.00	0.00	840.
0.08	6.	1.02	3.30	55	0.00	0.00	0.00	784.
0.08	5.	1.02	4.00	56	0.00	0.00	0.00	732.
0.08	5.	1.02	4.30	57	0.00	0.00	0.00	683.
0.08	5.	1.02	5.00	58	0.00	0.00	0.00	637.
0.08	4.	1.02	5.30	59	0.00	0.00	0.00	594.
0.08	4.	1.02	6.00	60	0.00	0.00	0.00	554.
0.08	4.	1.02	6.30	61	0.00	0.00	0.00	517.
0.08	4.	1.02	7.00	62	0.00	0.00	0.00	483.
0.05	8.	1.02	7.30	63	0.00	0.00	0.00	450.
0.05	23.	1.02	8.00	64	0.00	0.00	0.00	420.
0.05	53.	1.02	8.30	65	0.00	0.00	0.00	392.
0.05	98.	1.02	9.00	66	0.00	0.00	0.00	366.
0.05	156.	1.02	9.30	67	0.00	0.00	0.00	341.
0.05	220.	1.02	10.00	68	0.00	0.00	0.00	318.
0.05	283.	1.02	10.30	69	0.00	0.00	0.00	297.
0.05	339.	1.02	11.00	70	0.00	0.00	0.00	277.
0.05	385.	1.02	11.30	71	0.00	0.00	0.00	259.
0.05	423.	1.02	12.00	72	0.00	0.00	0.00	241.
0.05	455.	1.02	12.30	73	0.00	0.00	0.00	225.
0.05	481.	1.02	13.00	74	0.00	0.00	0.00	210.
0.05	534.	1.02	13.30	75	0.00	0.00	0.00	196.
0.05	666.	1.02	14.00	76	0.00	0.00	0.00	183.
0.05	914.	1.02	14.30	77	0.00	0.00	0.00	171.
0.05	1298.	1.02	15.00	78	0.00	0.00	0.00	159.
0.05	1814.	1.02	15.30	79	0.00	0.00	0.00	149.
0.05	2436.	1.02	16.00	80	0.00	0.00	0.00	139.
0.05	3127.	1.02	16.30	81	0.00	0.00	0.00	129.
0.05	3991.	1.02	17.00	82	0.00	0.00	0.00	121.
0.05	5085.	1.02	17.30	83	0.00	0.00	0.00	113.
0.05	6259.	1.02	18.00	84	0.00	0.00	0.00	105.
0.05	7367.	1.02	18.30	85	0.00	0.00	0.00	98.
0.05	8223.	1.02	19.00	86	0.00	0.00	0.00	91.
0.05	8666.	1.02	19.30	87	0.00	0.00	0.00	85.
0.05	8600.	1.02	20.00	88	0.00	0.00	0.00	80.
0.05	8044.	1.02	20.30	89	0.00	0.00	0.00	74.
0.05	7227.	1.02	21.00	90	0.00	0.00	0.00	69.
0.05	6340.	1.02	21.30	91	0.00	0.00	0.00	65.
0.05	5449.	1.02	22.00	92	0.00	0.00	0.00	60.
0.05	4617.	1.02	22.30	93	0.00	0.00	0.00	56.
0.05	3899.	1.02	23.00	94	0.00	0.00	0.00	53.
0.05	3303.	1.02	23.30	95	0.00	0.00	0.00	49.
0.05	2808.	1.03	0.00	96	0.00	0.00	0.00	46.
0.05	2398.	1.03	0.30	97	0.00	0.00	0.00	43.
0.05	2057.	1.03	1.00	98	0.00	0.00	0.00	40.
0.00	1772.	1.03	1.30	99	0.00	0.00	0.00	37.
0.00	1528.	1.03	2.00	100	0.00	0.00	0.00	35.

SUM 25.38 22.58 2.80 126865.
 (645.)(573.)(71.)(3592.42)

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
6652.	2535.	1208.	126844.
183.	72.	30.	3592.
15.09	23.01	23.98	23.98

MM	383.34	584.35	609.16	609.16
AC-FI	3296.	5028.	5241.	5241.
THOUS CU M	4069.	6202.	6465.	6465.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 1

2.	1.	1.	1.	1.	1.	1.	1.
1.	1.	2.	5.	11.	20.	31.	44.
77.	85.	91.	96.	107.	133.	163.	260.
625.	798.	1017.	1252.	1473.	1645.	1733.	1720.
1268.	1090.	923.	780.	651.	562.	480.	411.
263.	225.	190.	168.	157.	146.	137.	127.
103.	97.	90.	84.	78.	73.	68.	64.
52.	48.	45.	42.	39.	37.	34.	32.
26.	24.	23.	21.	20.	18.	17.	16.
13.	12.	11.	11.	10.	9.	9.	8.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1733.	1330.	507.	254.	25369.
CMS	49.	38.	14.	7.	718.
INCHES		3.02	4.60	4.80	4.80
MM		76.67	116.87	121.83	121.83
AC-FI		660.	1006.	1048.	1048.
THOUS CU M		814.	1240.	1293.	1293.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 2

3.	2.	2.	2.	2.	2.	2.	2.
1.	1.	3.	8.	18.	34.	54.	77.
135.	148.	159.	168.	187.	233.	320.	454.
1095.	1397.	1760.	2191.	2578.	2878.	3033.	3010.
2219.	1907.	1516.	1305.	1156.	983.	839.	720.
460.	393.	333.	294.	274.	256.	239.	223.
161.	169.	158.	147.	137.	128.	119.	111.
91.	84.	79.	74.	69.	64.	60.	56.
45.	42.	39.	37.	34.	32.	30.	28.
23.	21.	20.	18.	17.	16.	15.	14.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3033.	2328.	887.	444.	44395.
CMS	86.	66.	25.	13.	1257.
INCHES		5.28	8.05	8.39	8.39
MM		134.17	204.52	213.21	213.21
AC-FI		1154.	1760.	1835.	1835.
THOUS CU M		1424.	2171.	2263.	2263.

HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 3

4.	4.	3.	3.	3.	3.	3.	2.
2.	2.	4.	11.	26.	49.	78.	110.
192.	212.	227.	241.	267.	333.	457.	649.
1564.	1990.	2542.	3129.	3683.	4111.	4333.	4300.
3170.	2724.	2309.	1950.	1652.	1404.	1199.	1029.
657.	561.	475.	420.	392.	366.	341.	318.
259.	241.	225.	210.	195.	183.	171.	159.
129.	121.	113.	105.	98.	91.	85.	80.
65.	60.	56.	53.	49.	46.	43.	40.
32.	30.	28.	26.	25.	23.	21.	20.

609.16	609.16
5241.	5241.
6465.	6465.

R PLAN 1, RTIO 1

1.	1.	1.	1.	1.
20.	31.	44.	57.	68.
133.	163.	260.	363.	487.
1645.	1733.	1720.	1609.	1445.
562.	480.	411.	354.	306.
146.	137.	127.	119.	111.
73.	68.	64.	59.	55.
37.	34.	32.	30.	28.
18.	17.	16.	15.	14.
9.	9.	8.	7.	7.

R	72-HOUR	TOTAL VOLUME
.	254.	25369.
.	7.	718.
0	4.80	4.80
7	121.83	121.83
.	1048.	1048.
.	1293.	1293.

R PLAN 1, RTIO 2

2.	2.	2.	2.	1.
34.	54.	77.	99.	119.
233.	320.	454.	635.	853.
2878.	3033.	3010.	2816.	2529.
983.	839.	720.	620.	535.
256.	239.	223.	208.	194.
128.	119.	111.	104.	97.
64.	60.	56.	52.	49.
32.	30.	28.	26.	24.
16.	15.	14.	13.	12.

R	72-HOUR	TOTAL VOLUME
.	444.	44395.
.	13.	1257.
5	8.39	8.39
2	213.21	213.21
.	1835.	1835.
.	2263.	2263.

R PLAN 1, RTIO 3

3.	3.	2.	2.	2.
49.	78.	110.	141.	169.
333.	457.	649.	907.	1218.
4111.	4333.	4300.	4022.	3613.
1404.	1199.	1029.	886.	764.
366.	341.	318.	297.	277.
183.	171.	159.	149.	139.
91.	65.	80.	74.	69.
46.	43.	40.	37.	35.
23.	21.	20.	19.	17.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VO
CFS	4333.	3320.	1207.	634.		63
CMS	123.	94.	30.	18.		1
INCHES		7.50	11.50	11.99		1
MM		191.07	292.17	304.58		30
AC-FT		1049.	2514.	2021.		2
THOUS CU M		2034.	3101.	3233.		3

HYDROGRAPH AT STA 1 FOR PLAN 1, RT10 4							
5.	5.	4.	4.	4.	4.	3.	
2.	2.	5.	15.	34.	64.	101.	
250.	275.	290.	313.	347.	433.	594.	
2033.	2594.	3305.	4008.	4789.	5345.	5633.	5
4121.	3542.	3001.	2534.	2147.	1825.	1559.	1
854.	730.	618.	540.	510.	476.	444.	
336.	314.	293.	273.	255.	238.	222.	
108.	157.	140.	137.	127.	119.	111.	
84.	78.	73.	68.	64.	59.	55.	
42.	39.	37.	34.	32.	30.	28.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VO
CFS	5633.	4324.	1648.	824.		82
CMS	100.	122.	47.	23.		2
INCHES		9.81	14.95	15.59		1
MM		249.17	379.83	395.95		39
AC-FT		2144.	3266.	3407.		3
THOUS CU M		2645.	4031.	4202.		4

HYDROGRAPH AT STA 1 FOR PLAN 1, RT10 5							
0.	0.	5.	5.	5.	4.	4.	
3.	3.	0.	18.	42.	78.	124.	
308.	332.	304.	305.	427.	533.	731.	1
2502.	3193.	4008.	5007.	5094.	6578.	6933.	6
5072.	4559.	3094.	3119.	2643.	2247.	1918.	1
1051.	898.	761.	672.	627.	585.	546.	
414.	380.	300.	336.	314.	293.	273.	
207.	193.	180.	108.	157.	146.	137.	
103.	97.	90.	84.	78.	73.	68.	
52.	48.	45.	42.	39.	37.	34.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL	VO
CFS	6933.	5321.	2028.	1015.		101
CMS	190.	151.	57.	29.		2
INCHES		12.07	18.40	19.19		1
MM		306.07	467.48	487.33		48
AC-FT		2639.	4022.	4193.		4
THOUS CU M		3255.	4962.	5172.		5

HYDROGRAPH AT STA 1 FOR PLAN 1, RT10 6							
8.	7.	7.	0.	0.	5.	5.	
4.	4.	8.	23.	53.	98.	150.	
305.	423.	455.	461.	534.	660.	914.	
3127.	3991.	5085.	6259.	7307.	8223.	8666.	
6340.	5449.	4517.	3899.	3303.	2808.	2398.	

EAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
33.	3320.	1207.	634.	63422.
23.	94.	30.	18.	1790.
	7.55	11.50	11.99	11.99
	191.07	292.17	304.58	304.58
	1049.	2514.	2021.	2621.
	2034.	3101.	3233.	3233.

OGRAH AT STA 1 FOR PLAN 1, RTIO 4

4.	4.	4.	3.	3.	3.	3.
15.	34.	64.	101.	143.	184.	220.
313.	347.	433.	594.	844.	1179.	1584.
4008.	4789.	5345.	5633.	5590.	5229.	4697.
2534.	2147.	1825.	1559.	1337.	1152.	993.
540.	510.	476.	444.	414.	386.	360.
273.	255.	238.	222.	207.	193.	180.
137.	127.	119.	111.	104.	97.	90.
68.	64.	59.	55.	52.	48.	45.
34.	32.	30.	28.	26.	24.	23.

EAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
33.	4324.	1648.	824.	82449.
60.	122.	47.	23.	2335.
	9.81	14.95	15.59	15.59
	249.17	379.83	395.95	395.95
	2144.	3268.	3407.	3407.
	2645.	4031.	4202.	4202.

OGRAH AT STA 1 FOR PLAN 1, RTIO 5

5.	5.	4.	4.	4.	4.	3.
18.	42.	78.	124.	176.	226.	271.
385.	427.	533.	731.	1039.	1451.	1949.
5007.	5094.	6578.	6933.	6880.	6436.	5781.
3119.	2643.	2247.	1918.	1646.	1418.	1222.
672.	627.	585.	546.	510.	475.	444.
336.	314.	293.	273.	255.	238.	222.
108.	157.	146.	137.	127.	119.	111.
84.	78.	73.	68.	64.	59.	55.
42.	39.	37.	34.	32.	30.	28.

EAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
33.	5321.	2028.	1015.	101475.
90.	151.	57.	29.	2873.
	12.07	18.40	19.19	19.19
	306.67	467.48	487.33	487.33
	2639.	4022.	4193.	4193.
	3255.	4962.	5172.	5172.

OGRAH AT STA 1 FOR PLAN 1, RTIO 6

6.	6.	5.	5.	5.	4.	4.
23.	53.	98.	150.	220.	283.	339.
461.	534.	660.	914.	1298.	1814.	2436.
6259.	7367.	8223.	8666.	8600.	8044.	7227.
3899.	3203.	2808.	2398.	2057.	1772.	1528.

1314.	1123.	351.	840.	784.	732.	683.	637.	594
517.	483.	450.	420.	392.	366.	341.	318.	297
259.	241.	225.	210.	196.	183.	171.	159.	149
129.	121.	113.	105.	98.	91.	85.	80.	74
65.	60.	56.	53.	49.	46.	43.	40.	37

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8000.	6652.	2535.	1268.	126844.
CMS	245.	188.	72.	36.	3592.
INCHES		15.09	23.01	23.98	23.98
MM		383.34	584.35	609.16	609.16
AC-FT		3298.	5028.	5241.	5241.
THOUS CU M		4069.	6202.	6465.	6465.

HYDROGRAPH ROUTING

ROUTING OF INFLOW HYDROGRAPH

	ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISLAGE
	2	1	0	0	0	0	1	0
	ROUTING DATA							
	GLOSS	CLOSS	AVG	IRES	ISAME	IJPT	IPMP	LSIR
	0.0	0.000	0.00	1	1	0	0	0
	NSIPS	NSILL	LAG	AFSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	-1.	0
AGE	0.00	50.00	100.00	175.00	340.00	415.00	690.00	
	1100.00							
LOW	0.00	35.00	46.00	55.00	120.00	210.00	235.00	
	13055.00							

STATION 2, PLAN 1, RTIO 1

OUTFLOW							
2.	2.	2.	2.	2.	1.	1.	1.
1.	1.	1.	1.	2.	2.	3.	4.
8.	11.	13.	15.	18.	20.	24.	30.
44.	48.	53.	64.	85.	109.	164.	212.
227.	230.	233.	304.	458.	514.	517.	490.
361.	316.	277.	241.	235.	234.	234.	234.
232.	232.	231.	231.	230.	230.	229.	228.
227.	226.	225.	225.	224.	223.	222.	222.
220.	219.	218.	217.	217.	216.	215.	214.
212.	211.	211.	209.	200.	190.	182.	173.
STOR							
2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	3.	4.	5.
12.	15.	18.	22.	25.	29.	35.	43.
92.	119.	155.	199.	252.	313.	377.	440.
601.	640.	672.	696.	710.	716.	716.	713.
702.	675.	654.	631.	607.	584.	560.	536.
601.	555.	500.	444.	388.	332.	275.	218.

84.	732.	683.	637.	594.	554.
92.	366.	341.	318.	297.	277.
96.	183.	171.	159.	149.	139.
98.	91.	85.	80.	74.	69.
49.	46.	43.	40.	37.	35.

24-HOUR	72-HOUR	TOTAL VOLUME
2535.	1268.	126844.
72.	36.	3592.
23.01	23.98	23.98
584.35	609.16	609.16
5028.	5241.	5241.
6202.	6465.	6465.

GRAPH ROUTING

ITAPE	JPLT	JPRT	INAME	ISIAGE	IAUTO
0	0	0	1	0	0

PIPING DATA

ISAME	IJPT	IPMP	LSTR
1	0	0	0

ANSKK	X	TSK	STORA	ISPRAT
0.000	0.000	0.000	-1.	0

00	340.00	415.00	690.00	800.00	935.00	1010.00
00	120.00	210.00	235.00	1440.00	5645.00	8650.00

2, PLAN 1, RTIO 1

OUTFLOW

2.	1.	1.	1.	1.	1.
2.	2.	3.	4.	5.	7.
18.	20.	24.	30.	36.	39.
85.	109.	164.	212.	218.	223.
158.	514.	517.	490.	451.	406.
235.	234.	234.	234.	233.	233.
230.	230.	229.	228.	228.	227.
224.	223.	222.	222.	221.	220.
217.	216.	215.	214.	214.	213.
200.	190.	182.	173.	165.	158.

STOR

2.	2.	2.	2.	2.	2.
2.	3.	4.	5.	7.	9.
25.	29.	35.	43.	54.	70.
252.	313.	377.	440.	500.	554.
710.	710.	710.	713.	710.	706.
687.	684.	680.	676.	671.	666.
638.	632.	625.	618.	611.	604.

597.	590.	583.	575.	568.	560.	552.	544.
541.	512.	504.	496.	488.	480.	472.	464.
439.	431.	423.	414.	406.	399.	391.	384.

	PEAK	5-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	517.	381.	265.	164.	16437.
C4S	15.	11.	7.	5.	465.
INCHES		0.86	2.40	3.11	3.11
MM		21.95	61.04	78.94	78.94
AC-FT		189.	525.	679.	679.
THOUS CU M		233.	648.	838.	838.

STATION 2, PLAN 1, RTIO 2

				STOK			
4.	4.	4.	4.	4.	4.	4.	4.
4.	3.	3.	4.	4.	5.	7.	9.
21.	26.	32.	38.	44.	51.	61.	75.
163.	212.	274.	352.	443.	547.	659.	759.
631.	822.	1013.	1304.	1795.	2444.	3272.	4360.
730.	121.	114.	108.	103.	699.	696.	694.
688.	680.	683.	679.	675.	671.	667.	662.
640.	640.	634.	627.	621.	614.	607.	600.
570.	571.	563.	556.	548.	540.	532.	524.
500.	492.	484.	476.	468.	460.	452.	443.

75.	508.	560.	552.	544.	536.	528.
90.	486.	400.	472.	464.	455.	447.
114.	406.	399.	391.	384.	378.	371.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

5-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
381.	265.	164.	16437.
11.	7.	5.	465.
0.86	2.40	3.11	3.11
21.95	61.04	78.94	78.94
189.	525.	679.	679.
233.	648.	838.	838.

MAXIMUM STORAGE = 716.

STATION 2, PLAN 1, RTIO 2

OUTFLOW

3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	5.	6.	9.	12.
20.	31.	35.	37.	41.	45.	49.
134.	213.	222.	232.	991.	1993.	2525.
567.	1387.	1270.	1137.	1005.	882.	769.
431.	377.	336.	303.	276.	254.	235.
234.	234.	233.	233.	232.	232.	231.
229.	229.	228.	227.	227.	226.	226.
223.	222.	221.	221.	220.	219.	218.
210.	215.	214.	213.	213.	212.	211.

STOR

4.	4.	4.	4.	4.	4.	4.
4.	4.	5.	7.	9.	12.	17.
38.	44.	51.	61.	75.	96.	125.
352.	443.	547.	659.	759.	818.	835.
804.	795.	784.	772.	760.	749.	739.
708.	703.	699.	696.	694.	692.	690.
679.	675.	671.	667.	662.	657.	651.
627.	621.	614.	607.	600.	593.	586.
556.	548.	540.	532.	524.	516.	508.
470.	468.	460.	452.	443.	435.	427.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2525.	1586.	617.	342.	34156.
CMS	72.	45.	17.	10.	967.
INCHES		3.60	5.60	6.46	6.46
MM		91.40	142.23	164.03	164.03
AC-FT		786.	1224.	1411.	1411.
THOUS CU M		970.	1510.	1741.	1741.

MAXIMUM STORAGE = 835.

STATION 2, PLAN 1, RIIIO 3

OUTFLOW								
4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	3.	3.	4.	4.	5.	7.	9.	12.
21.	26.	32.	36.	38.	40.	43.	47.	51.
79.	106.	164.	218.	230.	1063.	3141.	4062.	4140.
3499.	3067.	2636.	2239.	1896.	1608.	1406.	1298.	1172.
921.	806.	700.	607.	533.	476.	431.	394.	362.
310.	268.	266.	249.	235.	235.	235.	234.	234.
233.	233.	232.	232.	232.	231.	230.	230.	229.
228.	228.	227.	226.	226.	225.	224.	224.	223.
221.	221.	220.	219.	219.	216.	217.	216.	216.

STOR								
5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	6.	7.	10.	13.	18.
30.	38.	40.	54.	63.	74.	88.	109.	139.
236.	305.	393.	502.	633.	767.	855.	884.	887.
806.	852.	838.	826.	815.	805.	797.	787.	776.
753.	742.	732.	724.	717.	712.	708.	704.	702.
697.	695.	693.	691.	690.	688.	685.	683.	679.
671.	667.	662.	657.	652.	646.	640.	634.	628.
615.	608.	601.	594.	586.	579.	572.	564.	556.
541.	533.	525.	517.	509.	501.	493.	485.	477.

STAGE								
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4140.	2731.	985.	522.	52212.
CMS	117.	77.	28.	15.	1478.
					9.47

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
1586.	617.	342.	34156.
45.	17.	10.	967.
3.60	5.60	6.46	6.46
91.40	142.23	164.03	164.03
786.	1224.	1411.	1411.
970.	1510.	1741.	1741.

IMUM STORAGE = 835.

TION 2, PLAN 1, RTIO 3

OUTFLOW						
4.	4.	4.	4.	4.	4.	4.
4.	4.	5.	7.	9.	12.	17.
6.	38.	40.	43.	47.	51.	57.
8.	230.	1063.	3141.	4062.	4140.	3888.
9.	1896.	1608.	1406.	1298.	1172.	1044.
7.	533.	476.	431.	394.	362.	334.
9.	235.	235.	235.	234.	234.	234.
2.	232.	231.	230.	230.	229.	229.
6.	226.	225.	224.	224.	223.	222.
9.	219.	218.	217.	216.	216.	215.

STOR						
5.	5.	5.	5.	5.	5.	5.
5.	6.	7.	10.	13.	18.	24.
4.	63.	74.	88.	109.	139.	181.
2.	633.	767.	855.	884.	887.	879.
6.	815.	805.	797.	787.	776.	764.
4.	717.	712.	708.	704.	702.	699.
1.	690.	688.	685.	683.	679.	675.
7.	652.	646.	640.	634.	628.	621.
4.	586.	579.	572.	564.	556.	549.
7.	509.	501.	493.	485.	477.	469.

STAGE						
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
2731.	985.	522.	52212.
17.	28.	15.	1478.
0.00	0.03	0.07	0.07

MM	157.38	226.95	250.74	250.74
AC-FT	1354.	1953.	2158.	2158.
THOUS CU M	1070.	2409.	2661.	2661.

MAXIMUM STORAGE = 887.

STATION 2, PLAN 1, RTIO 4

OUTFLOW							
5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	0.	9.	12.
28.	34.	37.	39.	42.	45.	48.	51.
107.	189.	219.	232.	1489.	4291.	5229.	5529.
4551.	3987.	3427.	2911.	2464.	2090.	1778.	1520.
1138.	1010.	880.	774.	683.	613.	556.	509.
402.	374.	340.	324.	302.	281.	262.	245.
235.	234.	234.	234.	233.	233.	232.	232.
230.	230.	229.	229.	228.	227.	227.	226.
224.	223.	223.	222.	221.	221.	220.	219.

STOR							
7.	7.	7.	7.	7.	7.	7.	7.
7.	6.	6.	7.	7.	9.	12.	17.
39.	49.	59.	70.	82.	97.	116.	144.
308.	398.	511.	654.	802.	892.	922.	931.
900.	682.	664.	647.	633.	821.	811.	803.
772.	761.	749.	739.	731.	724.	719.	715.
705.	703.	700.	698.	696.	694.	692.	691.
685.	682.	678.	675.	670.	666.	661.	650.
639.	633.	620.	620.	613.	606.	599.	592.
570.	562.	555.	547.	539.	531.	523.	515.

STAGE							
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5529.	3884.	1360.	705.	70536.
CMS	157.	110.	39.	20.	1997.
INCHES		8.81	12.34	13.34	13.34
MM		223.80	313.49	338.74	338.74
AC-FT		1920.	2697.	2915.	2915.
THOUS CU M		2376.	3327.	3595.	3595.

MAXIMUM STORAGE = 931.

STATION 2, PLAN 1, RTIO 5

MM	157.38	226.95	250.74	250.74
FT	1354.	1953.	2158.	2158.
IN	1070.	2409.	2661.	2661.

MAXIMUM STORAGE = 887.

STATION 2, PLAN 1, RFD 4

OUTFLOW							
5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	0.	9.	12.	16.	22.
37.	39.	42.	45.	48.	51.	58.	80.
219.	232.	1489.	4291.	5229.	5529.	5435.	5065.
3427.	2911.	2404.	2090.	1778.	1520.	1376.	1264.
880.	774.	683.	613.	556.	509.	469.	434.
340.	324.	302.	281.	262.	245.	235.	235.
234.	234.	233.	233.	232.	232.	231.	231.
229.	229.	228.	227.	227.	226.	225.	225.
223.	222.	221.	221.	220.	219.	218.	218.

SIGN							
7.	7.	7.	7.	7.	7.	7.	7.
0.	7.	7.	9.	12.	17.	23.	31.
59.	70.	82.	97.	116.	144.	183.	237.
511.	654.	802.	892.	922.	931.	928.	916.
664.	647.	633.	621.	611.	603.	794.	784.
749.	739.	731.	724.	719.	715.	711.	708.
700.	698.	696.	694.	692.	691.	689.	687.
678.	675.	670.	666.	661.	656.	650.	645.
620.	620.	613.	606.	599.	592.	585.	577.
555.	547.	539.	531.	523.	515.	507.	499.

STAGE							
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PLAN	0-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3529.	3484.	1360.	705.	70536.
157.	110.	39.	20.	1997.
	8.61	12.34	13.34	13.34
	223.80	313.49	338.74	338.74
	1920.	2697.	2915.	2915.
	2370.	3327.	3595.	3595.

MAXIMUM STORAGE = 931.

2, PLAN 1, RFD 5

OUTFLOW								
0.	0.	0.	0.	0.	6.	6.	6.	6.
0.	0.	0.	0.	0.	8.	11.	15.	20
34.	37.	40.	43.	46.	48.	51.	56.	75
168.	217.	230.	1293.	4383.	5864.	6671.	6684.	6679
5516.	4889.	4213.	3582.	3033.	2572.	2189.	1870.	1605
1311.	1187.	1055.	930.	827.	745.	679.	623.	575
494.	459.	420.	398.	371.	346.	323.	301.	281
244.	235.	235.	235.	234.	234.	234.	233.	233
232.	231.	231.	230.	230.	229.	229.	228.	227
226.	225.	225.	224.	223.	223.	222.	221.	221

STOR								
9.	9.	9.	9.	9.	9.	8.	6.	6
8.	8.	8.	8.	9.	11.	15.	21.	28
49.	60.	73.	67.	102.	120.	144.	178.	227
380.	490.	630.	767.	894.	940.	961.	966.	961
951.	911.	889.	869.	851.	836.	824.	814.	805
788.	777.	765.	753.	744.	737.	731.	725.	721
714.	710.	708.	705.	702.	700.	698.	696.	694
691.	689.	687.	685.	682.	678.	675.	670.	666
656.	650.	645.	639.	633.	626.	620.	613.	606
592.	585.	577.	570.	562.	555.	547.	539.	531

STAGE								
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6884.	4984.	1740.	890.	89022.
CMG	195.	141.	49.	25.	2521.
INCHES		11.31	15.79	16.83	16.83
MM		287.23	401.12	427.52	427.52
AC-FT		2471.	3451.	3679.	3679.
THOUS CU M		3048.	4257.	4537.	4537.

MAXIMUM STORAGE = 966.

STATION 2, PLAN 1, RTIO 6

OUTFLOW								
5.	8.	8.	8.	8.	7.	7.	7.	7
7.	7.	7.	7.	8.	10.	13.	18.	2
37.	41.	44.	47.	49.	52.	56.	75.	63
215.	228.	1139.	4351.	6378.	7661.	8371.	8608.	20
6670.	5986.	5193.	4401.	3788.	3214.	2736.	2338.	7
1467.	1303.	1243.	1115.	1003.	913.	837.	771.	3
610.	573.	534.	497.	464.	432.	403.	376.	2
305.	285.	260.	247.	235.	235.	235.	234.	2

OUTFLOW

6.	6.	6.	6.	6.	6.	6.	6.
6.	6.	6.	8.	11.	15.	20.	26.
0.	43.	46.	48.	51.	56.	75.	102.
0.	1293.	4383.	5864.	6671.	6884.	6679.	6162.
3.	3582.	3033.	2572.	2189.	1870.	1605.	1413.
5.	930.	827.	745.	679.	623.	575.	532.
8.	398.	371.	346.	323.	301.	281.	262.
5.	235.	234.	234.	234.	233.	233.	232.
1.	230.	230.	229.	229.	228.	227.	227.
5.	224.	223.	223.	222.	221.	221.	220.

STOR

9.	9.	9.	9.	8.	6.	8.	8.
8.	8.	9.	11.	15.	21.	28.	38.
3.	87.	102.	120.	144.	178.	227.	294.
0.	787.	894.	940.	961.	966.	961.	948.
9.	869.	851.	836.	824.	814.	805.	797.
5.	753.	744.	737.	731.	725.	721.	717.
8.	705.	702.	700.	698.	696.	694.	692.
7.	685.	682.	678.	675.	670.	666.	661.
5.	639.	633.	626.	620.	613.	606.	599.
7.	570.	562.	555.	547.	539.	531.	523.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
6884.	4984.	1740.	890.	89022.
195.	141.	49.	25.	2521.
	11.31	15.79	16.83	16.83
	287.23	401.12	427.52	427.52
	2471.	3451.	3679.	3679.
	3048.	4257.	4537.	4537.

MAXIMUM STORAGE = 966.

STATION 2, PLAN 1, RTIO 6

OUTFLOW

8.	8.	7.	7.	7.	7.	7.
7.	7.	10.	13.	18.	25.	33.
4.	47.	49.	52.	56.	75.	99.
9.	4351.	6378.	7661.	8371.	8608.	6349.
3.	4401.	3788.	3214.	2736.	2338.	2006.
3.	1115.	1003.	913.	837.	771.	714.
3.	497.	464.	432.	403.	376.	351.
3.	247.	235.	235.	235.	234.	234.

233.	233.	232.	232.	232.	231.	230.	230.	23
228.	228.	227.	228.	228.	225.	224.	224.	23

STOR								
11.	11.	11.	11.	11.	11.	11.	11.	
10.	10.	10.	10.	12.	14.	19.	26.	
61.	16.	92.	110.	129.	151.	182.	225.	21
475.	613.	773.	893.	953.	985.	1003.	1009.	100
936.	944.	921.	897.	875.	857.	842.	829.	81
602.	793.	782.	770.	760.	752.	745.	739.	71
725.	721.	717.	714.	711.	708.	705.	703.	70
696.	695.	693.	691.	690.	688.	685.	682.	68
671.	667.	662.	657.	652.	646.	640.	634.	63
614.	608.	601.	594.	586.	579.	572.	564.	56

STAGE							
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6608.	5429.	2251.	1138.	113832.
CMS	244.	182.	64.	32.	3223.
INCHES		14.59	20.43	21.52	21.52
MM		370.51	519.00	546.67	546.67
AC-FT		3188.	4466.	4704.	4704.
THOUS CU M		3932.	5508.	5802.	5802.

MAXIMUM STORAGE = 1009.

232.	232.	231.	230.	230.	229.	229.
226.	226.	225.	224.	224.	223.	222.

STOR

11.	11.	11.	11.	11.	10.	10.
10.	12.	14.	19.	26.	36.	47.
110.	129.	151.	182.	225.	285.	368.
893.	953.	985.	1003.	1009.	1002.	986.
897.	875.	857.	842.	829.	818.	809.
770.	760.	752.	745.	739.	734.	729.
714.	711.	708.	705.	703.	701.	698.
691.	690.	688.	685.	682.	679.	675.
657.	652.	646.	640.	634.	628.	621.
594.	586.	579.	572.	564.	556.	549.

STAGE

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

0-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
5429.	2251.	1138.	113832.
182.	64.	32.	3223.
14.59	20.43	21.52	21.52
370.51	519.00	546.67	546.67
3188.	4466.	4704.	4704.
3932.	5508.	5802.	5802.

MAXIMUM STORAGE = 1009.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECO
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECO
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS				
				RATIO 1 0.20	RATIO 2 0.35	RATIO 3 0.50	RATIO 4 0.65	RATIO 0
HYDROGRAPH AT	1	4.10	1	1733.	3033.	4333.	5633.	69
	(10.62)		(	49.06)(	85.89)(	122.69)(	159.50)(	196.
ROUTED TO	2	4.10	1	517.	2525.	4140.	5529.	68
	(10.62)		(	14.63)(	71.50)(	117.22)(	156.55)(	194.

MARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 ER SECOND (CUBIC METERS PER SECOND)
 MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

IO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
0.35	0.50	0.65	0.80	1.00
3033.	4333.	5633.	6933.	8666.
5.89)(	122.69)(	159.50)(	196.31)(	245.39)(
2525.	4140.	5529.	6884.	8608.
1.50)(	117.22)(	156.55)(	194.94)(	243.76)(

APPENDIX D

ENGINEERING INVESTIGATION REPORT BY SCS
(CRACK INVESTIGATION)

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SYRACUSE, NEW YORK

ENGINEERING INVESTIGATION REPORT
ISCHUA CREEK WATERSHED
SITE 4

Investigating Committee

Donald E. Wallin, Civil Engineer, NETSC, Broomall, PA
Donald W. Lake, Jr., Civil Engineer, SCS, Syracuse, NY
Harry G. Hirth, Civil Engineer, Syracuse, NY

Project: Ischua Creek Watershed
Cattaraugus County, New York

Location: Approximately 12 miles north of the city of
Olean, New York and 40 miles south of Buffalo,
New York

Site Number: Floodwater Retarding Structure #4
Located approximately 3/4 mile northeast of the
village of Franklinville, New York

Problems: Cracks in the 36 inch diameter principal
spillway conduit.

Dates of Inspection August 1976, July 1977, October 1977, and May
1979

Floodwater Retarding Structure #4 is a class C structure having a drainage area of 4.1 sq. miles, fill height of 51 feet and containing about 103,000 cu. yds. of fill. This structure was built during the period from August 1962 to September 1963 by Sack Bros. Inc.

PROBLEMS

In August 1976, SCS conducted an inspection of principal spillways in the Ischua Creek Watershed. During this inspection cracks were discovered in the 36 inch conduit on this site. These cracks had developed in the pipes between joints C & D and E & F (attached sheet 7 of 11 of construction drawing, Exhibit 9) as shown in Exhibits 1-8 attached. Also, there are two other pipe lengths that show lime deposits.

PRINCIPAL SPILLWAY CONDUIT DESIGN

Designed in 1961	O.D.	3.52 ft. (Reinforced Cradle)	
Prestressed pipe	.001	Crack	11,108 #/LF
Non Prestressed	.01	Crack	14,774 #/LF
Redesigned in 1962 for change in O.D. 3.94 ft.			
	.001	Crack	12,322 #/LF
	.01	Crack	16,388 #/LF

Certification from manufacturer, Exhibit 10:

Three edge bearing @ .01 crack 16,500 #/LF

CONSTRUCTION

Work was started on this site on August 24, 1962, and completed August 31, 1963. Pipe was delivered to the site on September 11, started laying pipe on September 17, and completed with cradle October 2. During this period, Job Diary refers to problems in construction such as: "informed contractor joint "L" not closed in tight enough; shut job down due to rain, joint "B" settled over 3 inches; suggest superintendent get drainage.....in areas A, B, C, and D along pipe and cradle S.G., no pipe to be laid in muck; jacking pipe up to grade; low temperature on concrete this morning, 36°; checked RCP 36 inch at joint "Q", jack same up to grade; checked point "Q" again (.02 low), informed superintendent to jack same up; joint "Q" and.....went out of alignment on RCP, informed superintendent to take out and recompact S.G. and replace pipe in workman-like manner; pipe became damaged trying to straighten same in alignment, checked 36 inch RCP and found same OK; several references to wet conditions and orders to remove backfill to bottom of cradle and replace, informed contractor no equipment to pass over pipe or structure with less than 2 feet of cover; warned contractor of running with dozer over 36 inch RCCP; today contractor had shown very little respect to instructions given him covering specifications, don't care attitude; November 4 to May 14, 1963, winter shutdown; May 15, informed contractor to keep equipment off pipe until fill has two feet of compacted fill over it; contractor finished placing fill in first 2 feet over 36 inch RCP."

OPERATION AND MAINTENANCE

Operation and maintenance have been annually conducted without inspection of the conduit. In August 1976, an inspection was made by SCS which in turn discovered these problems. Therefore, it is impossible to determine at what period between construction in 1963 until they were discovered in 1976, that these cracks began to develop. Additional inspections were conducted in 1977 and 1979 with no apparent change.

OBSERVATIONS AND FINDINGS

The revised design of the conduit, based on furnished outside dimension required 16,388 #/lin. ft. (7/24/62) while manufacturers specification sheet lists under design conditions: In accordance with AWWA C-302, three edge bearings at .01 inch crack 16,500 #/lin. ft. (7-18-62). No documentation exists as to the origin of this figure which could have been an actual break of this pipe, a break from an equal pipe or a mathematical computation of some kind.

Many problems with the contractor were recorded in the Job Diary; holding pipe to line and grade, getting adequate compaction in structure backfill, equipment operating too close to pipe, and statements that contractor had little respect for contract requirements. Any or all of these items could have damaged or weakened pipe during construction. At this time all SCS personnel that were involved in the construction have left the Service and are unavailable for comment.

The cracks in pipe lengths C-D and E-F are in close proximity to anti-seep collars. Differential settlement in these areas may have contributed to the pipe cracking.

An analysis of required longitudinal steel was done in accordance with Design Note #9. See Exhibit 11. The longitudinal area of steel required by this analysis is 11.42 sq. in. That actually provided by six No. 3 bars listed on Exhibit 10 is 0.66 sq. in. This does not include additional longitudinal reinforcement being provided by the two cages of mesh. The contract documents do not state the size or type of mesh, so the additional cross sectional area of steel can not be determined, but it would seem unreasonable to assume the mesh would provide the additional area (10.76 in²) needed. Therefore, the pipe appears to be grossly lacking in longitudinal reinforcements.

It is important to recognize that the procedures in Design Note #9, used for determining the required area of longitudinal steel, were unavailable at the time this dam was designed and these same procedures were developed as a result of similar problems with this type of pipe (AWWA 302). AWWA 302 pipe has been used on very few sites in the state of New York and has not been used at all for more than ten years.

GEOLOGY

A review of the geologic investigation was made and can be summarized by the narrative from the report. "The heavy, blue gray till underlying the entire extent of the proposed principal spillway results in a very good foundation condition. DH1, in the vicinity of TP-302, had blow counts in the vicinity of 25-30 at spillway grade. TP 303 revealed either a large boulder or bedrock at about spillway grade. Just to be safe, I recommend that the downstream end of the pipe be moved 20 feet towards the stream. This should result in completely uniform conditions along the spillway." As-built plans indicate entire structure was relocated in design 20 to 30 feet towards the stream.

REPAIR

This structure has been inspected by the pipe manufacturer and their recommendation is that pipe be drilled and a silica gel grouted into the soil around the pipe. After this is accomplished, the cracks should be veed out and filled with lead wool and hydraulic cement. This cost was estimated to be approximately \$5,800 in 1977.

RECOMMENDATION

It is recommended that the repair work described above be done at federal cost. This is based on the fact that during construction, many problems occurred that could have resulted in damage to the pipe, and on a national level, we have discouraged the use of this type of pipe because of similar cracking problems.

Donald E. Wallin
Design Engineer
Broomall, Pennsylvania

Donald W. Lake, Jr.
Head, Design Section
Syracuse, New York

Harry G. Hirth,
Construction Engineer
Syracuse, New York

Concurred By:

State Conservation Engineer



EXHIBIT 1

OCTOBER 27, 1977, OKRA AND LIME
DEPOSITS FROM CRACK DEVELOPED IN
SIDEWALL OF 36" RCP.

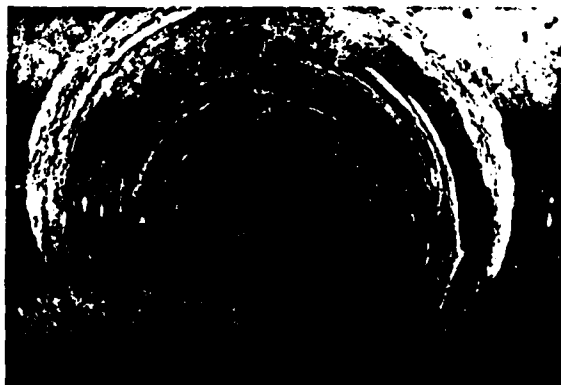


EXHIBIT 3

OCTOBER 27, 1977, LIME DEPOSITS
LOOKING DOWNSTREAM IN 36" RCP
NEAR JOINT E.



EXHIBIT 2

JULY 21, 1977, CLOSE UP VIEW
OF LOCATION SHOWN IN EXHIB-
IT 1.

AD-A090 934

NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. ISCHUA CREEK WATERSHED PROJECT, SI--ETC(U)
SEP 80 B L THOMSEN, G L WOOD DACW51-79-C-0001

UNCLASSIFIED

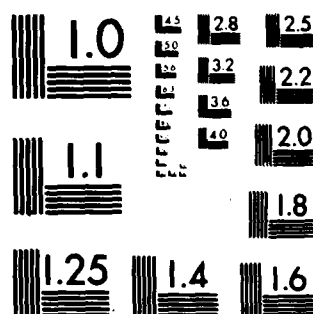
NL

2-2

2-2



END
DATE
FILMED
11-80
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

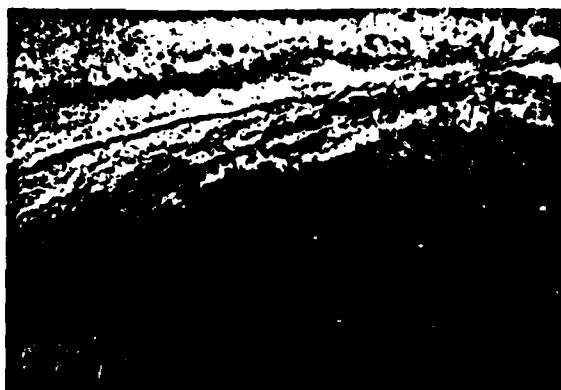


EXHIBIT 4

JULY 21, 1977, UPSTREAM CRACK IN
TOP LEFT OF 36" RCP NEAR CENTER
OF PIPE LENGTH C-D.

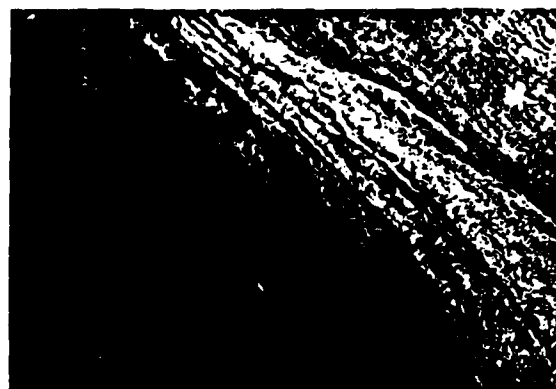


EXHIBIT 5

JULY 21, 1977, UPSTREAM CRACK IN
TOP RIGHT OF 36" RCP NEAR CENTER
OF PIPE LENGTH C-D.



EXHIBIT 6

JUNE 18, 1979, SAME CRACK AS
SHOWN IN EXHIBIT 4 WITH NO AP-
PRECIBLE CHANGE IN CONDITION.

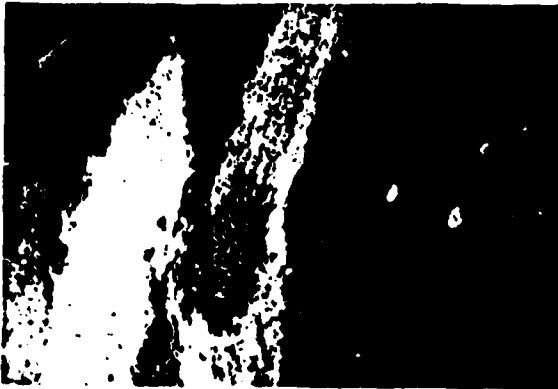


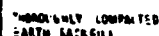
EXHIBIT 7

OCTOBER 27, 1977, LIME DEPOSITS
FROM SMALL CRACK IN SIDEWALL
OF 36" R.C.P.

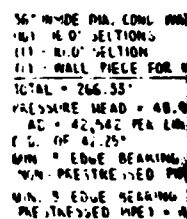


EXHIBIT 8

JUNE 18, 1979, PHOTO OF SAME
CRACK AS SHOWN IN EXHIBIT 7,
WITH NO APPRECIABLE CHANGE
IN CONDITION.



CONCRETE BEDDING

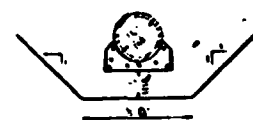


WALE: 1" : 20.0 MORI
1" : 10.4 VEAT

(DATE OF GEOLOGICAL INVESTIGATION - MAY 1961
(UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION,
NOT BY LABORATORY ANALYSIS

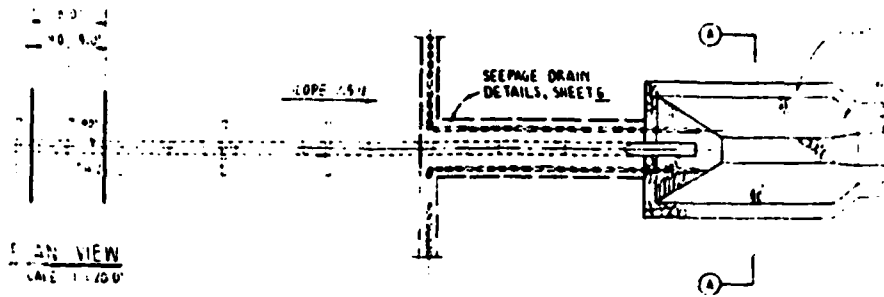
1.0' SOFT SHALE INTERBEDDED WITH THE SANDSTONE

IP - 304 ELEV.

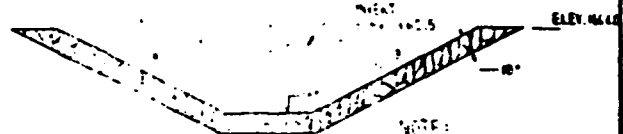


TYPICAL OUTLET CHANNEL

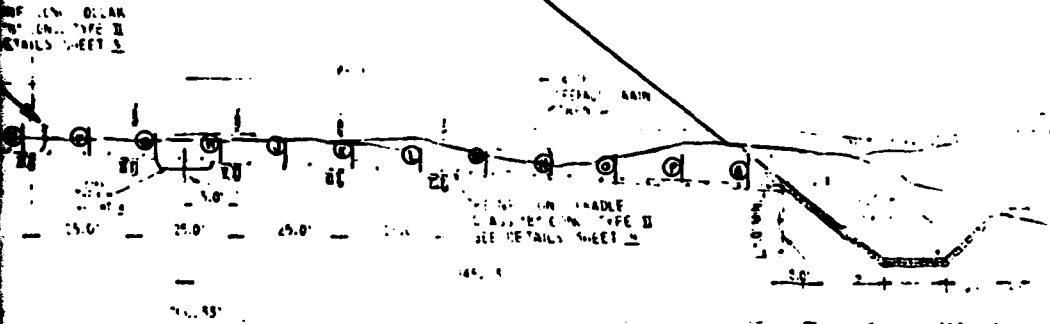
EXHIBIT 9



36" DIA. LOW WATER PIPE
 (1) 16.0' SECTIONS
 (2) 11.0' SECTION
 (3) WALL PIECE FOR 18" WALL
 TOTAL = 266.33'
 PRESSURE HEAD = 48.9'
 AD = 42,542 PER LIN. FT. BASED ON
 P.D. OF 42.25'
 MIN. 3 EDGE BEARING STRENGTH FOR 30" DIA. &
 MIN. PRESTRESSED PIPE = 14,174 LBS. PER LIN. FT.
 MIN. 3 EDGE BEARING STRENGTH FOR 30" DIA. &
 PRESTRESSED PIPE = 11,107 LBS. PER LIN. FT.



PROXIMATE LOCATION PIPE CRACKS



POINT	INVERT ELEV. OF WALL PIECE	WATER ELEV. OF 36" PIPE
A	0	166.1
B	16	166.15
C	26	167.01
D	42	167.61
E	50	168.12
F	74	168.12
G	90	168.37
H	106	168.38
I	122	168.27
J	139	168.13
K	156	168.02
L	170	168.10
M	176	168.11
N	207	168.38
O	218	168.45
P	230	168.45
WATER	250.11	250.11

WALL SHALL BE E. ABOVE
 MENTIONED FOR LENGTH OF
 TIME ARE NOMINAL & TO NOT
 IN EXCESS.

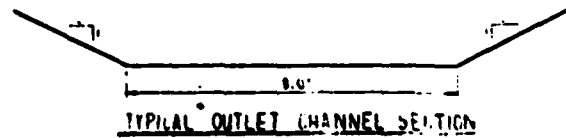
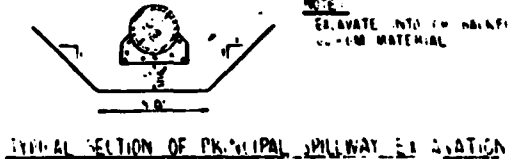
A	16.0	166.1
B	11.0	167.01
C	11.0	167.61
D	11.0	168.12
E	11.0	168.12
F	11.0	168.37
G	11.0	168.38
H	11.0	168.27
I	11.0	168.13
J	11.0	168.02
K	11.0	168.10
L	11.0	168.11
M	11.0	168.38
N	11.0	168.45
O	11.0	168.45
P	11.0	168.45

AS BUILT

ISCHUA CREEK WATERSHED PROJECT
 ISCHUA CREEK WATERSHED DAM NO. 4
 ISCHUA CREEK
 CATTARAUGUS CO., NEW YORK
 PLAN - PROFILE OF PRINCIPAL SPILLWAY
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

BY: S. G. GORMAN
 DATE: SEPT. 8
 BY: M. GORMAN
 DATE: DEC. 8
 BY: M. GORMAN
 DATE: DEC. 8

NY-804-P



SPECIFICATION

Exhibit 10

FOR 36" REINFORCED CONCRETE PRESSURE PIPE W/RUBBER & STEEL JOINT (SP-1)

ISCHUA CREEK WATERSHED DAM NO. 4

CATTARAUGUS COUNTY, NEW YORK

U.S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

SEE DRAWING D-2-712-36" Mk'd 7-17-62

Pipe Size	36	inches
Footage	268	feet
Design Conditions:		
In Accordance with AWWA C-302		
Three edge Bearing at .01" crack	16,500	lb./l.f.
Maximum Head	49	feet
Steel Design:		
Total Cage Area (Mesh)	1.279	sq.in./ft.
No. of Cages	2	
Cage Areas		
Inside	0.731	sq.in./ft.
Outside	0.568	sq.in./ft.
Longitudinals 3/8" ϕ Bars Equally Spaced in inside cage	6	
Joint Rings:		
Spigot Ring - Special section x 4-1/2 inches wide with 14 Ga. x 4" wide steel band		
Bell Ring 3/16" x 6 inches		
Both zinc coated		
Wall Thickness	5-5/8	inches
Joint Depth	3-3/8	inches
Average Creep	0.03	feet
Average Length	16.03	feet
Job Consists of:		
(10) Straights	256.48	feet
(1) Short (10'-3" O.A.)	10.00	feet
(1) Wall Fitting (Spigot)	--	feet
	266.48	

LOCK JOINT PIPE CO.

EAST ORANGE, N. J.

COMPILED

CHE. ATT.

APPROVED

DATE

New York Iscia Creek Site 4
D. Lake 10/16/79 DEW 10/26/79 Exhibit 11
Requirements of Design Note # 9

Re: Design Note # 9
Pg 4, equation (7)

$$A_s = \frac{4.33 C_f \gamma b_c H_c (L/2)}{f_s}$$

where:

C_f = friction coefficient
 γ = avg. wt. of embankment soil
 b_c = outside diameter of conduit
 H_c = height of fill over conduit
 L = section length of pipe (feet)
 f_s = allowable steel stress

$$A_s = \frac{(4.33)(.25)(138)(3.94)(48.5)(16/2)}{20,000 \text{ lbs/in}^2}$$

Using $C_f = 0.25$ for
the constructed condition.

$$\therefore A_s = \underline{\underline{11.42 \text{ in}^2 \text{ required}}}$$

From Exhibit 10

Longitudinal reinforcement shows 6, 3/8" diameter bars
equally spaced in inside cage.

$$A_s \text{ (Provided)} = (6)(.1105) = .6636 \text{ in}^2 \text{ for No. 3 bars}$$

Additional longitudinal reinforcement would be provided
from the two cages of mesh reinforcement; but
it would be unreasonable to assume that the
amount lacking could be made up by the mesh alone.

Construction records don't state the size and type of
mesh reinforcement in the pipe and the areas can't
be broken down for use.

APPENDIX E

DESIGN FOLDER

DESIGN REPORT

ISCHUA CREEK WATERSHED PROJECT SITE NO. 4, SAUNDERS CREEK CATTARAUGUS COUNTY, NEW YORK

This floodwater retarding dam is located on Saunders Creek, a tributary of Ischua Creek. It is located approximately one mile northwest of the town of Franklinville in Cattaraugus County, New York. Sheet 4 of this report is a transparent overlay which when placed on the Franklinville 15' quadrangle published by the U. S. Geological Survey, will assist in locating the dam. The dam is on property owned by Carl Forward and Ed Bednarski.

This dam has been classified as a class (c) structure in accordance with criteria as established in Washington Engineering Memorandum SCS-27.

The drainage area above the dam is 4.10 square miles.

The purpose of this dam is to provide temporary storage for the runoff from 2,624 acres, which will reduce flooding downstream. This temporary storage is gradually released through the principal spillway at the low stage and high stage elevations.

The components of the dam are a compacted earth fill, principal spillway, two emergency spillways and a combined drainage system for the dam and foundation.

The principal spillway consists of a 36-inch reinforced concrete water pipe and a 3' x 9' reinforced concrete riser.

The vegetated emergency spillways (base width ^{100 & 200} ~~150~~ feet) will not be used until the runoff exceeds 3.2 inches for a 6-hour duration storm.

The inflow hydrographs used in the design of this structure were developed by the method described in the Engineering Handbook, Hydrology, section 4, part 3.21, USDA, SCS.

The flood routing procedure used in the design is described in the Engineering Handbook, Hydraulics, section 5, USDA, SCS. This flood routing procedure was used to determine the maximum stages shown in the following table.

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ENGINEERING & WATERSHED PLANNING UNIT
UPPER DARBY, PENNSYLVANIA

DRAWING NO.
NY-804-R

SHEET 1 OF 4

DATE 11/22/61

DESIGN REPORT

Factor Which De-termines Stage	Surface Area Acres	Runoff in Inches	Peak Inflow CFS	Peak Outflow CFS	Elev. of Maximum Stage	Storage in Ac.-Ft.	Element of Structure Determined by Maximum Stage
50 year sediment accumulation	4.8	-	-	-	1682.5	31	Crest of orifice
5 year frequency storm	26.2	1.5	788	-	1703.2	295	Crest of riser
100 year frequency storm moisture condition III	59.2	3.2	1682	-	1713.0	689	Check of emergency spillways
1.75x6 hour point rain-fall moisture condition II	73.0	9.4	4940	3800	1715.9	888	Design high water
2.5 x6 hour point rain-fall moisture condition II	80.0	14.7	7452	6800	1717.2	968	Check top of dam

The duration of flow and the maximum velocity in the emergency spillway for the design storm is 7.69 hours and 7.25 feet per second, respectively.

The time to empty the pool from the crest of the emergency spillway to the crest of the orifice is 5.0 days.

The geology report and Soil Mechanics Laboratory report were used to determine the adequacy of the design. Copies of these reports are attached.

The following publications were used in the design of this dam:

NE Handbook No. 5, Hydraulics
 NE Handbook No. 4, Hydrology
 NE Handbook No. 6, Structural Design
 Technical Releases Nos. 2, 5 and 10

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 ENGINEERING & WATERSHED PLANNING UNIT
 UPPER DARBY, PENNSYLVANIA

DRAWING NO.
 NY-804-R

SHEET 2 OF 4
 DATE 11/22/61

Iskua Creek Watershed

Site # 4.

Charger Trade

(1) Original stage storage curve was based on a 5' contour interval map.

A new stage-storage curve was computed based on a 2' contour interval map up to elev. 1686 and a 5' contour interval map from elev. 1692 to 1720.

(2) The more accurate curve indicated less storage at the lower elevations: the sediment pool elev. (crest of orifice) was increased from elev. 1682.5 to elev. 1684.2.

(3) The surface area of the sediment pool increased from 4.8 ac. to 5.6 ac.

(4) Check of storage in low stage

(a) Using TR #10 and limiting the storage in the low stage (elev. of crest ^{of riser} remain the same as in the original design - 1703.2) the required release rate of the orifice was determined.

(b) The release rate is increased from 49 cfs to 65 cfs. This increase will not effect the desired benefits downstream.

(c) Size orifice changes from 1'x2' to 1'x2'-8"

(5) Check for min. elev. of crest of emergency spill.
Using TR #10 these conditions were checked.
All resulted in lower elevations than in original design.

(6) Flood routing for DHW and freeboard ^{in original design} was started @ elev. 1687.0 (5 day draw down).
Flood routing can be started @ 1686.00 or lower (6 day drawdown). ∴ It appears that flood routing again is not necessary since the elev. of top of dam and crest of em. spillway will not be changed. (crest not increased).

(4)

Summary

	Redesign	original
Crest of Orifice	1684.2	1682.5
Crest of Piers	1703.2	1703.2
Crest of Cr. Spill.	1713.0	1713.0
Top of Dam	1717.2	1717.2

same

Orifice Size

1' x 2'-8"

1'-2'

Sediment pool area

5.6 ac.

4.8 ac.

NY,
LCI
Site #4 - Summary Sheet

Ischua Creek Watershed
NY-804

pg #1

Top Settled Fill _____ El. 1717.2

Crest Em. Spillway _____ El. 1713.0

Crest of Riser _____ El. 1703.2

Sediment Pool _____ El. 1684.2

Sediment Pool Area _____ 5.6 Ac.

Orifice Size _____ 1' x 2'-8"

Design Criteria

X
Sheet # 2

2/6/61

Tyler

Ny 904

1. Structure Classification "C"
2. Set elevation of Permanent Pool to store 50 yrs sediment minus allocation for Flood pool
3. This is a two stage structure
4. Picer Crest is set by routing 5yr. storm thru a 2'x1' orifice
5. Emergency Spillway Crest is set by routing a 100 yr. storm through a 36" Principal Spillway Pipe.
6. Riser Dimensions 8'x9' (inside)
7. Set design high water & freeboard by recommended suggestions in memo 47 E+VPU.
8. Width of Emergency Spillway - 2 - 150' Side slopes 3
9. Dam fill - upstream Slope 3:1
Berms 2
Downstream Slope 2 1/2:1

RECONCILIATION SHEET

Sheet 15
NY 804

	UNIT	WORK PLAN	DESIGN	REMARKS
DRAINAGE AREA	SQ. MI.	4.1	4.1	
STORAGE CAPACITY				
SEDIMENT	AC. FT.	31	31	
FLOODWATER DETENTION	AC. FT.	679	689	
WATER SUPPLY	AC. FT.	—	—	
SURFACE AREA				
SEDIMENT POOL	AC.	7.5	5.8	
FLOODWATER DETENTION POOL	AC.	66.5	59.2	
WATER SUPPLY	AC.	—	—	
MAXIMUM HEIGHT OF DAM	FT.	51	51	
VOLUME OF FILL	CU. YD.	103050	98373	
EMERGENCY SPILLWAY				
TYPE		Earth	Earth	
AREA OF USE	YR.	100yr	100yr	
DESIGN STORM RAINFALL				
DURATION	HR.	6	6	
TOTAL	IN.	12.4	12.4	
BOTTOM WIDTH	FT.	300	2-150'	
DESIGN DEPTH	FT.	3.0	2.9	
DESIGN CAPACITY	CFS	3990	3800	
FREEBORD	FT.	1.5	1.3	
TOTAL CAPACITY	CFS.	6150	6800	
PRINCIPAL SPILLWAY CAPACITY	CFS.	189	189	
CAPACITY EQUIVALENTS				
SEDIMENT VOLUME	IN.	0.14	0.14	
SPILLWAY STORAGE	IN.	1.96	1.28	
DETENTION VOLUME	IN.	3.14	3.15	
CLASS OF STRUCTURE		C	C	

NY, Isehua Creek Watershed
LCI
Site #4 - Summary Sheet
NY-804 p. #1

Top Settled Fill _____ El. 1717.2

Crest Em. Spillway _____ El. 1713.0

Crest of Riser _____ El. 1703.2

Sediment Pool _____ El. 1684.2

Sediment Pool Area _____ 56 Ac

Orifice Size _____ ~~1' x 2'~~ 1'-4" x 2'-0" ^{LCI} 5/15/63

Revised Calculation
Raise Orifice from 1682.5 to 1684.2

Summary Sheet

Job Name — Reservoir #4
 Job No. — NY-304

Top of Settled Fill	El. 1717.2
Design High Water	El. 1715.9
Crest of Emergency Spillway	El. 1713.0
Crest of River	El. 1703.2
Sediment Pool	El. 1682.51684
Principal Spwy. Outlet	El. 1662.5
Top of Dam Width	18.0 Ft.
Emergency Spwy. Widths	100.0 ft. North 200.0
Berm Width (1) Upstream	10.0 Ft.
Berm Elevation	168.75 to 168.
Size of Riser	30' x 9.0'
Size of Orifice	2' x 1' x 2'
Size of Principal Spwy.	36"
Length of Principal Spwy.	266.0'
Height of Dam	51.0'
Dam Side Slopes	
Downstream	2 1/2:1
Upstream	3:1
Emergency Spwy. Side Slopes	3:1
Drainage Area	2624 Acres.
Floodwater Detention Capacity	687 Ac.-Ft.
Sediment Storage	31 Ac.-Ft.
Sediment Pool Area	5.5 Acres
	57.6

PRELIMINARY DESIGN DATA-CLASS C STRUCTURE

Isobua Creek NAME WATERSHED WORK PLAN New York STATE
STRUCTURE NO. 4 DRAINAGE AREA 2624 ACRES

(VALUES GIVEN IN INCHES REFER TO INCHES OVER THE WATERSHED)

1. PRECIPITATION

P_A (1.5x6-HR. VALUE) 13.6 INCHES
 P_B (2.5x6-HR. VALUE) 19.8 INCHES

2. RUNOFF FOR

HYDROGRAPH A $\frac{1}{P_A}$ AND CONDITION III 9.4 INCHES
HYDROGRAPH B $\frac{2}{P_B}$ AND CONDITION II 14.7 INCHES

3. PEAK INFLOW RATE FOR

HYDROGRAPH A $\frac{1}{P_A}$ 4940 C. F. S.
HYDROGRAPH B $\frac{2}{P_B}$ 7452 C. F. S.

4. PEAK OUTFLOW RATE

PRINCIPAL SPILLWAY

LOW STAGE 40.2 C. F. S.
HIGH STAGE 187.7 C. F. S.

EMERGENCY SPILLWAY

DESIGN CAPACITY 3800 C. F. S.
MAXIMUM CAPACITY (TO TOP OF DAM) 6800 C. F. S.

5. STORAGE AT ELEVATION OF

PRINCIPAL SPILLWAY

STAGE	INCHES	ACRE-Feet
LOW STAGE	0.14	31
HIGH STAGE	1.49	326
EMERGENCY SPILLWAY-CREST	3.29	720
HIGH WATER LINE-DESIGN CAPACITY	4.20	919
HIGH WATER LINE-MAXIMUM CAPACITY	4.56	999

6. EMERGENCY SPILLWAY

CRITICAL VELOCITY AT DESIGN CAPACITY-CONTROL SECTION 7.25 F. P. S.
DURATION OF FLOW THROUGH SPILLWAY FOR DESIGN HYDROGRAPH 7.69 HOURS
BOTTOM WIDTH AT CONTROL SECTION 2(150') FEET
LENGTH, CONTROL SECTION TO EXIT 608485 FEET
CONSTRUCTED IN (EXCELLENT)-(GOOD)-(FAIR)-(POOR) Good
EROSION RESISTING MATERIALS

- $\frac{1}{2}$ DESIGN HYDROGRAPH-VALUES USED TO DETERMINE EMERGENCY SPILLWAY DIMENSIONS FOR SAFE VELOCITIES
 $\frac{1}{2}$ MAXIMUM PROBABLE HYDROGRAPH-VALUES USED TO DETERMINE EMERGENCY SPILLWAY FREEBOARD

(CONTINUED ON REVERSE)

7. ELEVATION OF POOL AT

PRINCIPAL SPILLWAY

LOW STAGE ----- 1682.5 ----- FEET

HIGH STAGE ----- 1703.2 ----- FEET

EMERGENCY SPILLWAY-CREST ----- 1713.0 ----- FEET

HIGH WATER LINE-DESIGN CAPACITY ----- 1715.9 ----- FEET

HIGH WATER LINE-MAXIMUM CAPACITY ----- 1717.2 ----- FEET

8. EARTH FILL

ELEVATION TOP OF SETTLED FILL ----- 1717.2 ----- FEET

MAXIMUM HEIGHT OF FILL ----- 51.2 ----- FEET

9. APPROVED AS CLASS C DESIGN

DATE _____ SIGNED _____
STATE CONSERVATION ENGINEER

DATE _____ SIGNED _____
HEAD, E. W. P. UNIT

GEOLOGY REPORT

REPORT NO. NY-804-G

Prepared By B. S. Ellis
Geologist
SCS, Syracuse, New York

W. J. Atkinson
State Conservation Engineer
SCS, Syracuse, New York

STATE New York WATERSHED Ischua Creek

SITE NUMBER 4 LOCATION Franklinville, N.Y.

INVESTIGATED BY B.S. Ellis DATE May 1961

EQUIPMENT USED Backhoe, Acker Drill Rig

SITE DATA:

DRAINAGE AREA 4.10 SQ. MILES, 2624 ACRES
4.05 (2,592)

TYPE OF STRUCTURE Earth Fill CLASS C PURPOSE Flood Control

HEIGHT OF FILL 51 FEET: LENGTH OF FILL 920 FEET

VOLUME OF FILL (COMPACTED) 98,903 (above ground) CU.YDS.

LOCATION OF SPILLWAY North & South Abutments

ALLOCATED STORAGE:

	Surface Area (Acres)	Volume (Ac. Ft.)
Sediment	<u>5.8</u>	<u>31</u>
Floodwater	<u>59.2</u>	<u>689</u>

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DRAWING NO.
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SURFACE GEOLOGY & PHYSIOGRAPHY

This site is located in the Allegheny Plateau physiographic province. The topography in the area is generally of the glacial-depositional type of the Binghamton drift. Morainal deposits are very common in the area. The material in the uplands is predominantly till with occasional kames and kame terraces of gravel.

The valley slopes, or abutments, range from about 8% to a maximum of 28%, with a short distance of bluff-like topography just off the valley floor. The flood plain itself is about 200 feet wide at the C/L of the dam.

Sandstone is exposed on the north abutment, and is of Devonian Age. It is generally thick-bedded, ranging up to 24" thick, with the majority being about 12". There are some shaly zones that are weathered and open on the face of the outcrop. These constitute only a fraction of the total profile, however. Regional dip is 50 feet to the mile in a generally southwesterly direction. There is some jointing discernible, trending generally north-south.

Two or three minor seeps were observed in the bedding planes of the sandstone on the north abutment.

The channel downstream from the structure is reasonably stable under present conditions. It is paved with large (6" to 18") flags ranging up to 3" in thickness. Installation of the structure should have little effect on this channel.

SUBSURFACE GEOLOGY

Centerline of Dam

Two drill holes and five backhoe test pits were dug along the C/L of the dam. DH-1, on the south edge of the flood plain, was carried to a depth of 31.5 feet. It was sampled at the 5 and 10 feet depths and then continuously below 10 feet. (TP-302, dug near DH-1, provides a continuous profile from 0-10 feet.) There were no low volume-weight materials encountered. A boulder was encountered at the 7 foot depth and the hole was not cased below this depth. There was little or no caving, indicating the density of the material. Blow count averaged around 35/foot down to the 20 foot depth and then jumped to around 200. The material was moist to a depth of 25 feet and then changed to a dry material. At the 21 foot depth, an 8" boulder was cored. The material sampled in the spoon was

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
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visually classified as a CL. However, backhoe test pits 301 and 302, in the same blue gray material, were visually classified as GM. The material is a very dense till, with numerous large cobbles. It is a toss up to classify without a sieve analysis, and might go either way.

DH-2, on the north edge of the flood plain, encountered rock at a depth of 7 feet. The rock was cored from 7 feet to 13 feet. Recovery amounted to about 3 feet for this distance. The material over the rock is a brown, compact till.

Backhoe test pits 3 and 4 on the north side of the valley were dug to depths of 10 and 6 feet, respectively. In general, both pits were in a very dense silt with numerous small gravels and occasional cobbles. There was a very slight seepage at the 8 foot depth in TP-3, and none in TP-4.

TP-5 and 6 on the south side of the valley revealed about 6 feet of tight, fine-grained brown till, (CL) underlain by 2 feet of coarser till and then sandier material below the 8 foot depth. TP-5 was carried to a depth of 5 feet and TP-6 to a depth of 9 feet.

TP-7 was dug in what appeared to be a soft spot in the flood plain. However, the material is dense and relatively dry below the 3 foot depth and consists of a blue-gray till. The matrix is a CL with a fairly good gradation of +4's up to 3".

Several minor seep zones were observed along the bedrock face on the north abutment. These seeps occur along the bedding planes of the sandstone.

Principal Spillway

Three test pits were dug along the C/L of the principal spillway. One at the riser location, one at the outlet and one at midpoint. No samples were taken of the material.

All of the pits revealed a very dense blue-gray till at design grade, overlain by alluvial gravel or brown till.

TP-303 had a very large boulder, or bedrock at grade elevation.

Emergency Spillway

Twelve test pits and six drill holes were drilled in the emergency spillways. Two samples were taken of the material in the north spillway and are from the south.

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
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Bedrock was encountered along the north edge of the north spillway. The estimated volume of this rock to be excavated is 6,000 cu. yds.

The material overlying the rock and in the rest of the north spillway is quite uniform. It is a dense glacial till, consisting of approximately 30-40% +4 material tightly embedded in the matrix.

At design grade, the material is not particularly erosive.

In the south spillway, four test pits were dug along the C/L with the backhoe, starting at 3+00 upstream and ending at the level section. Dense brown till, slightly coarser and cleaner than on the north side, overlies a sandier material.

Borrow Area

Eight backhoe test pits were dug in an area east of the north spillway. The material, considering a composited profile, is uniform. One composited sample from test pit 103 was taken as representative of the material in the area.

In general, the entire area has 4 or 5 feet of silt with considerable +4 material in it, underlain by a coarser till that classified visually as a GM. The northern portion of the area is shallow (9'-10') to weathered bedrock.

Based on an 8 foot overall depth, there are approximately 56,000 cu. yds. of material available in this area.

Construction Materials

There was no source of clean gravel or suitable filter material revealed on this site during this investigation.

Rip rap will probably be available from the rock excavation in the north spillway.

Water

There was very little seepage in any of the test pits, and ground water observations in the drill holes would be invalidated by the influence of drilling water. Water for construction purposes will have to come from impounding the surface stream in the vicinity of the dam site.

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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JAN. 1959

SUPPLEMENT TO GEOLOGY REPORT ISCHUA CREEK WATERSHED SITE 4

(For In-Service Use Only)

INTERPRETATIONS AND RECOMMENDATIONS

Centerline of Dam

Foundation materials along the C/L of this structure are competent. The abutments consist generally of a dense brown till material. The north abutment, above the bedrock, consists of a very dense matrix with tightly bound cobbles and occasional boulders. This matrix, probably an ML or CL, is consistent to the depth of the test pits. The south abutment, on the other hand, has a sandier, more permeable material underlying the relatively impermeable till. This sand occurs at a depth of about 8 feet.

The valley bottom, or flood plain, has bedrock at a depth of 7 feet on the north side and very dense, blue gray till to at least a depth of 31 feet on the south side. The minimum blow count on this material was 14 at a depth of 5 feet. From 10 to 20 feet, the count averages around 35 and then jumps into the +100 range.

For a height of about 15-20 feet above the valley floor on the north abutment, sandstone is exposed. There has been considerable weathering of the soft shale beds between the sandstone layers, with a resultant slumping of large blocks of the sandstone.

It appears from the foregoing that differential settlement will not be a problem on this site, in spite of the fact that we have bedrock at a shallow depth (7') on the north side of the valley and deeper than 31 feet on the south side, less than 170 feet away. The material on the south side is dense enough to preclude any settlement for this depth of fill. The abutments are a good heavy till, so no problem exists in that quarter.

I recommend, however, that the weathered rock on the north side of the valley be removed. It should be cleaned back to a regular face of fresh, solid rock. There is a considerable amount of soft shale that is interbedded with the sandstone. This shale broke up during core drilling, resulting in frequent recoveries of 50%. Undisturbed, and covered with fill, this shale should not present any problem with respect to permeability or settlement.

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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As mentioned in the beginning of this report, there are several seeps in the bluff on the north side of the valley, the highest being approximately 12 feet above the flood plain. At the time of this investigation (May 1961), there was probably 1 to 2 gallons per minute flowing from them. I noticed what appeared to be some sort of spring development on one. A rusty length of pipe protruded from a large crevasse in the rock, with water coming out of it as well as around it. The old road used to run through the valley, so it is a possibility. I mention this because it does give some indication that the seeps are not strictly wet-weather. It seems feasible to include drainage on this side of the fill to take care of this water. There are no discernible seeps on the south abutment. Considering the material, this is to be expected.

Principal Spillway

The heavy, blue gray till underlying the entire extent of the proposed principal spillway results in very good foundation conditions. DH-1, in the vicinity of TP-302, had blow counts in the vicinity of 25-30 at spillway grade. TP-303 revealed either a large boulder or bedrock at about spillway grade. Just to be safe, I recommend that the downstream end of the pipe be moved 20 feet toward the stream. (See dashed line on site plan view.) This should result in completely uniform conditions along the spillway.

Emergency Spillway

North - Bedrock was encountered in three drill holes in this spillway. By using the three point system and assuming plane conditions on the rock surface, a volume of 6,000 cu. yds. of rock excavation was computed. In the absence of very close hole spacing, it would be nearly impossible to define this rock both vertically and laterally, especially the latter. It seems safe to assume that at least a partial bluff condition exists, as at the lower elevation. Because of the interbedded shale, this rock should not be too difficult to excavate. I do not believe it can be ripped, but should blast rather readily.

The unconsolidated material at spillway grade is satisfactory. It is rather resistant to erosion and vegetation should establish readily.

The length of the slopes on the uphill side of the spillway excavation approach the area whereby it seems some erosion control is necessary. There is also the possibility of seepage emerging at the contact of the mantle and the bedrock, although the material in the drill holes was on the dry side.

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
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South - There seems to be two problems connected with this spillway, as planned. One concerns the need for a dike from a point just below the level section upstream to somewhere beyond the C/L of dam intersection. Possibly realignment and relocation of the level section will alter this somewhat.

The second problem is that of the material at design grade from the level section downstream. It is quite erodible. I would recommend planning on over-excavating and backfilling with more resistant material that would also allow better establishment of vegetation.

Borrow Areas

In addition to the emergency spillways, a borrow area was investigated to the east of the north spillway. The investigation of this was not completed, however. Legal difficulties forced a cancellation of further work in this area. It will probably be necessary to go back sometime in the future and finish the job. The area south of the present borrow, if the material is satisfactory, would probably lend itself better to hauling onto the fill, at least from the standpoint of station-yards.

The borrow-excavation-fill relationship is tabulated in this manner:

Total Fill (above ground)	98,903	
Loss Factor (X1.5)		148,000
South Spillway	19,000	
North Spillway (Less Rock)	73,000	
Borrow Area (Needed)	<u>56,000</u>	148,000

This 56,000 cu. yds. of extra needed borrow can be obtained from the area east of the north spillway.

D. S. Ellis

Geologist, SCS
Syracuse, N.Y.

REFERENCE:

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DRAWING NO.

NY-804-G

SHEET 3 OF 3

DATE June 1961

TO : W. S. Atkinson, State Conservation Engineer, DATE: August 24, 1961
SCS, Syracuse, New York

FROM : Rey S. Decker, Head, Soil Mechanics Laboratory,
SCS, Lincoln, Nebraska

SUBJECT: New York WP-2, Ischua Creek, Site No. 4
Preliminary Report

ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 1 sheet.
2. Form SCS 355, Triaxial Shear Test Data, 3 sheets.
3. Form SCS 352, Compaction and Penetration Resistance Report, 4 sheet.
4. Form SCS 353, Grain Size Distribution Graph, 2 sheets.
5. Form SCS 357, Summary - Slope Stability Analysis, 1 sheet.
6. Geological Plans and Profiles.

DISCUSSION

FOUNDATION:

No samples were submitted for analyses.

Interbedded sandstone and shale is exposed at the base of the right abutment. The bedrock contact drops off rather sharply under the flood plain section. A test hole 31 feet deep at the base of the left abutment did not penetrate the bedrock.

On the right abutment, above the bedrock exposure, the material is logged as a dense till, and ranges from ML to GM. The material on the south or left abutment is logged as a dense CL and GM till to an 8-foot depth. The dense till is underlain by a more permeable sandy material classed as SM. The depth of the SM was not determined.

Flood plain materials consist of several feet of alluvial gravel and gravelly sands. In general, it appears that the alluvium is from 3 to 5 feet thick. It is noted, however, that the alluvium could be as much as 7 to 9 feet thick in test hole 301.

The material underlying the alluvial gravels is logged as a dense till and was classified as a CL or GM.

Blow count data was obtained in test hole No. 1. There is some question as to the moisture content of the till. The geologic report and the moisture column on the drillers log refers to this material as moist to a 20-foot depth. We note a discrepancy on the drillers log, in the visual classification and remarks column, where this same zone is referred to as dry. High blow count was obtained. However, we cannot relate blow count to saturated shear strength without a better idea of the moisture content. With the present information, we don't know whether the high blow count is due to a dry till or whether the till is actually near saturation and feels moist because it is extremely dense.

Key 3. Dicker

Subj: New York WP-2, Ischua Creek, Site No. 4
Preliminary Report

EMBANKMENT:

- A. Classification: Four borrow samples were submitted from the emergency spillways and the borrow area. The four samples are very similar. They have from 26 to 44 percent fines with 5 to 8 percent 2 micron clay. The samples are classed as GC-GM and GM.
- B. Compacted Density: Standard Proctor compaction tests were made on the minus No. 4 size fraction. The minus No. 4 densities ranged from 116.5 p.c.f. to 123.0 p.c.f.

Maximum density and optimum moisture content for various percentages of material larger than No. 4 size are shown on the attached compaction reports.

- C. Permeability: A permeability test was made on Sample 62W331. The test was made on material passing the 1-inch size. The test was made at 95 percent of Standard Proctor density with a correction applied for 22 percent gravel. No percolation occurred in 6 days.
- D. Shear Strength: Triaxial shear tests were made on Samples 62W331 and 62W333. The samples were regraded as shown on the attached Forms SCS 353. Four-inch diameter shear specimens were tested. The regraded material was molded to 95 percent of Standard density at saturation. Similar strength values were obtained on both materials. The difference can be attributed to the higher density and better gradation of Sample 62W333.

In addition to the four-inch diameter shear tests, a shear test was made on the minus # 4 size fraction. This test was made to check the effect of gradation and specimen size on shear strength. The test data is attached for informational purposes and the test is not charged to this site.

SLOPE STABILITY:

Stability of the proposed slopes was checked with a trial failure arc through the downstream section of the embankment only. With a full phreatic line, a 2 1/2:1 slope showed a factor of safety of 1.92. Under sudden drawdown a 3:1 upstream slope, with 10-foot berms as proposed, would have a factor of safety in the same range as that obtained on the downstream slope.

It must be emphasized that this analysis applies to the embankment and does not consider the foundation strength.

RECOMMENDATIONS

We do not have enough information on the foundation to make specific recommendations for a Class C embankment of this size.

We recommend that in-place density tests be made and disturbed samples from the same zones be submitted for classification. In addition to in-place density tests, we suggest field permeability tests to determine drainage requirements.

U. S. Army Corps of Engineers -- 6/1/61

Ray S. Decker

Subj: New York WP-2, Tscheta Creek, Site No. 4
Preliminary Report

In-place density tests should be taken of the alluvial gravel and the underlying till in the flood plain, and in the till on the abutments.

Field permeability tests should be made in the alluvial gravel, and in the underlying till, and also in the dense CL till and in the SM on the south abutment.

In addition to the in-place density determinations and field permeability tests, we recommend another test hole at about sediment pool elevation on the south abutment. The test hole should penetrate to about elevation 1664. This would provide information on stratification in the south abutment.

The in-place density tests and disturbed classification samples will provide a basis for estimating shear strength and consolidation potential. The field permeability tests will provide a basis determining drainage requirements and cutoff depth. In this respect, we are concerned primarily with the need for drainage in the south abutment and in the flood plain. For instance, it may be possible that the alluvial gravels are permeable enough to serve as a blanket drain:

The field permeability tests should be made in accordance with designation E-19 in the "Bureau of Reclamation Earth Manual". The test is designated as field permeability test (well permeameter method).

Additional information on the geologic history of this valley would also be helpful. Based on the present information, it appears that this could be either a valley entrenched into a glacial drift deposit that parallels an interbedded sandstone and shale escarpment, or a valley deeply entrenched in the bedrock and backfilled with glacial till. The SM on the south abutment may indicate a stratified drift or a residual sand layer over the bedrock.

On the basis of the present information, we would recommend a cutoff trench through the alluvial gravel and into the dense till.

Seeps on the north abutment in the interbedded shale and sandstone indicate a need for drainage in this section of the valley.

We concur with the geologist's recommendation to remove the weathered rock on the north side to solid rock under the entire embankment area.

Attachments

cc: H. M. Kautz, Upper Darby, Pa.
Bernard S. Ellis, Syracuse, New York
Henry W. Davis, Penn Yan, New York
Jesse Wicks, Little Valley, N. Y. (2)

Prepared by:

Lorn P. Dunnigan
Lorn P. Dunnigan

Reviewed and Approved by:

R. B. Phillips
Roland B. Phillips

U. S. DEPARTMENT OF AGRICULTURE
FOREIGN COMMERCE SERVICE

LOCATION AND DESCRIPTION	DEPTH	FIELD CLASS- IFICATION	GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT																
			FINES					SANDS								GRAVEL			
			0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm	
SPILLWAY	1-8'	ML GM	7	10	21	35	44	47	49	50	52	53	60	66	69	75	80		
SPILLWAY	1-9'	ML GM	8	10	20	31	36	38	39	40	42	47	55	64	68	72	77		
SPILLWAY	1-8'	GM	7	9	18	30	39	44	49	52	57	61	68	75	78	82	85		
	1-10'	ML-5 GM	5	8	14	21	26	28	30	31	35	40		61	67	73	77		

BY DRY WEIGHT						ATTENDING LIMITS		UNIT CLASS WEIGHT	VOLUME CALCULATED	TEST VERSION	MOISTURE - DENSITY RELATIONSHIP		UNIT SAMPLE		Gs	SPECIAL TESTS			
GRAVEL						LL	PL				STANDARD METHOD	MODIFIED	DRY DENSITY	OPTIMUM WATER		7 DAY WATER	SL. A WATER	Sheet	Comp Firmness	Atterberg Limits
NO.	1/2"	3/4"	1"	1 1/2"	2"						DRY DENSITY	OPTIMUM WATER	7 DAY WATER	SL. A WATER					
6	69	75	80	86	90	22	5	GC- GM		21	①				2.61	COARSE			
												116.5	12.5		2.69	FINES			
DRY DENSITY < #4 MATERIAL																			
2	68	72	77	83	88	24	7	GC- GM		14	②				2.62	COARSE	✓	180	
												119.0	13.0		2.72	FINES			
DRY DENSITY < #4 MATERIAL																			
7	78	82	85	89	92	19	3	GC- GM		29	③				2.62	COARSE			
												121.0	11.0		2.72	FINES			
DRY DENSITY < #4 MATERIAL																			
1	67	73	79	87	89	22	6	GC- GM		8	④				2.61	COARSE			
												123.0	11.0		2.73	FINES	✓		
DRY DENSITY < #4 MATERIAL																			

100-20 (Rev. 8/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

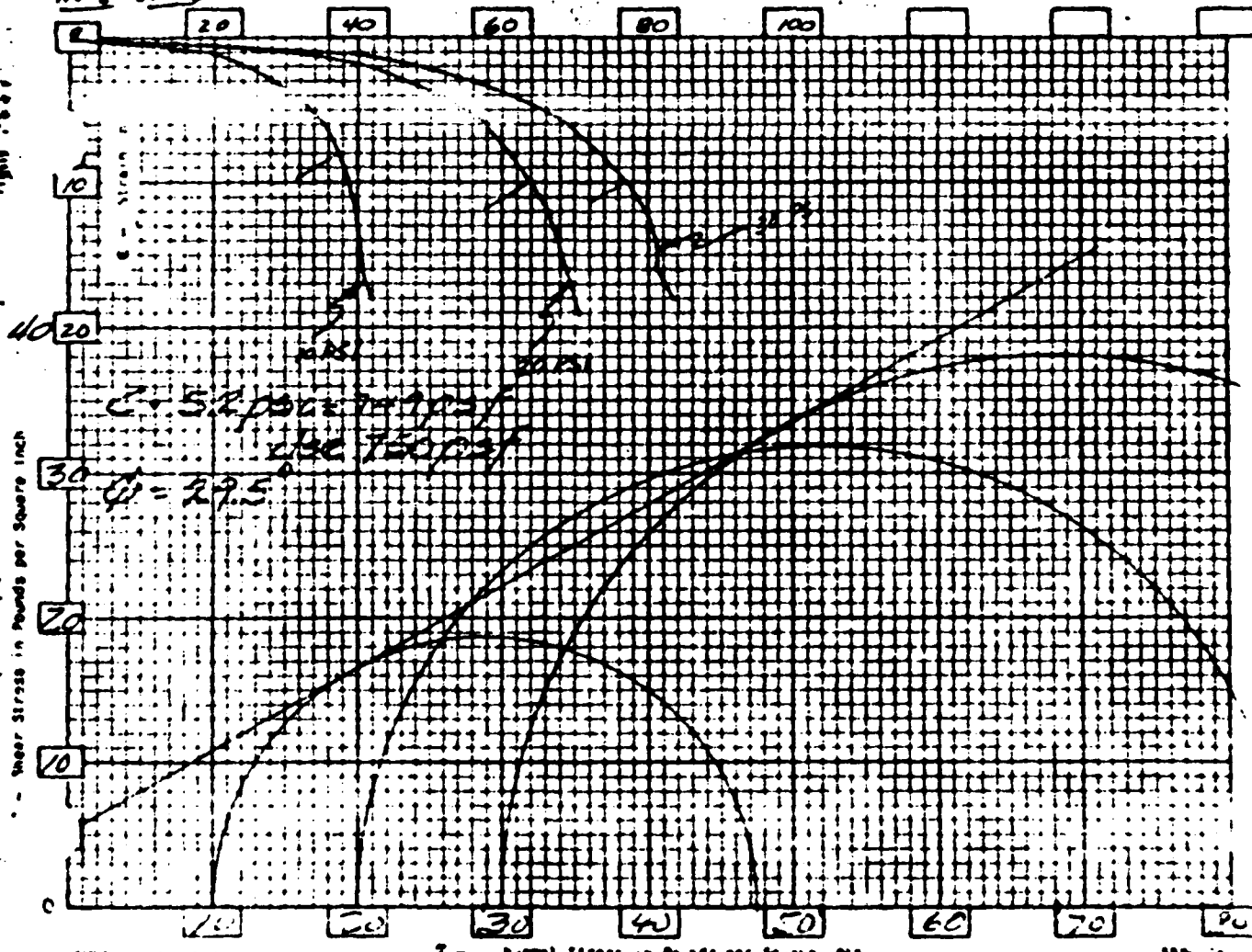
Sample Number 62M333

Project ISCHUA CREEK SITE No. 4 Location NEW YORK

Moisture-Density Data				Specifications:							
Standard <input checked="" type="checkbox"/> Max. γ <u>131.0</u> pcf		Modified <input type="checkbox"/> Optimum Moisture <u>8</u> %		Specimen: Max. <input type="checkbox"/> Consolidated <input type="checkbox"/> Drained		Weight <u>1.1</u> Size <u>1/2"</u> <input type="checkbox"/> Unconsolidated <input checked="" type="checkbox"/> Undrained					
Curve No. <u>1</u> of <u>1</u>		L.L. <u>22</u> P.L. <u>6</u> Class <u>CL-ML</u> , <u>2.65</u>		Diameter <u>1.0</u> Material		<input type="checkbox"/> Undisturbed and Tested at: <input type="checkbox"/> Natural Moisture <input type="checkbox"/> Saturation					
S Finer Than: 0.002mm <u>0.005mm</u> <u>200</u>		Other Factors Affecting Shear:		<input checked="" type="checkbox"/> Remolded and Tested at: <u>95</u> % of <input checked="" type="checkbox"/> Standard <input type="checkbox"/> Modified		with $w =$ <u>8</u> % which is					
S Dispersion <u>0</u> S Salt <u>0</u>		Other: <u>Molded @ Sat</u>		<input type="checkbox"/> Lower than Optimum <input type="checkbox"/> Optimum <input type="checkbox"/> Higher than Optimum		<input type="checkbox"/> Saturated					
Test Data											
Dry Density γ pcf	S Max. Dry Den.	Moisture Content			Lateral Pressure σ_3	Consolidation Data		Stress at Failure $\sigma_1 - \sigma_3$	Strain at Failure ϵ	Internal Friction ϕ Tan ϕ	Unit Cohesion
		Start %	S Sat. Start	End %		Orig. e_0	Final e_f				
124.9	95.3	11.8	92.9	10.5	10	0.3399	0.3009	57.5	8	29.5	52 psi 750 psi
125.5	95.8	11.8	95.2	10.4	20	0.3333	0.2909	63.0	10		
124.9	95.3	11.8	92.9	10.2	50	0.3399	0.2947	76.2	10		

NOTE SCALE

$\sigma_1 - \sigma_3$ in Pounds per Square Inch



σ - Normal Stress in Pounds per Square Inch

SOIL MECHANICS LABORATORY

Sample Number CSH 231

TRIAxIAL SHEAR TEST DATA

Project ISCHUA CR SITE No. 4

Location NEW YORK

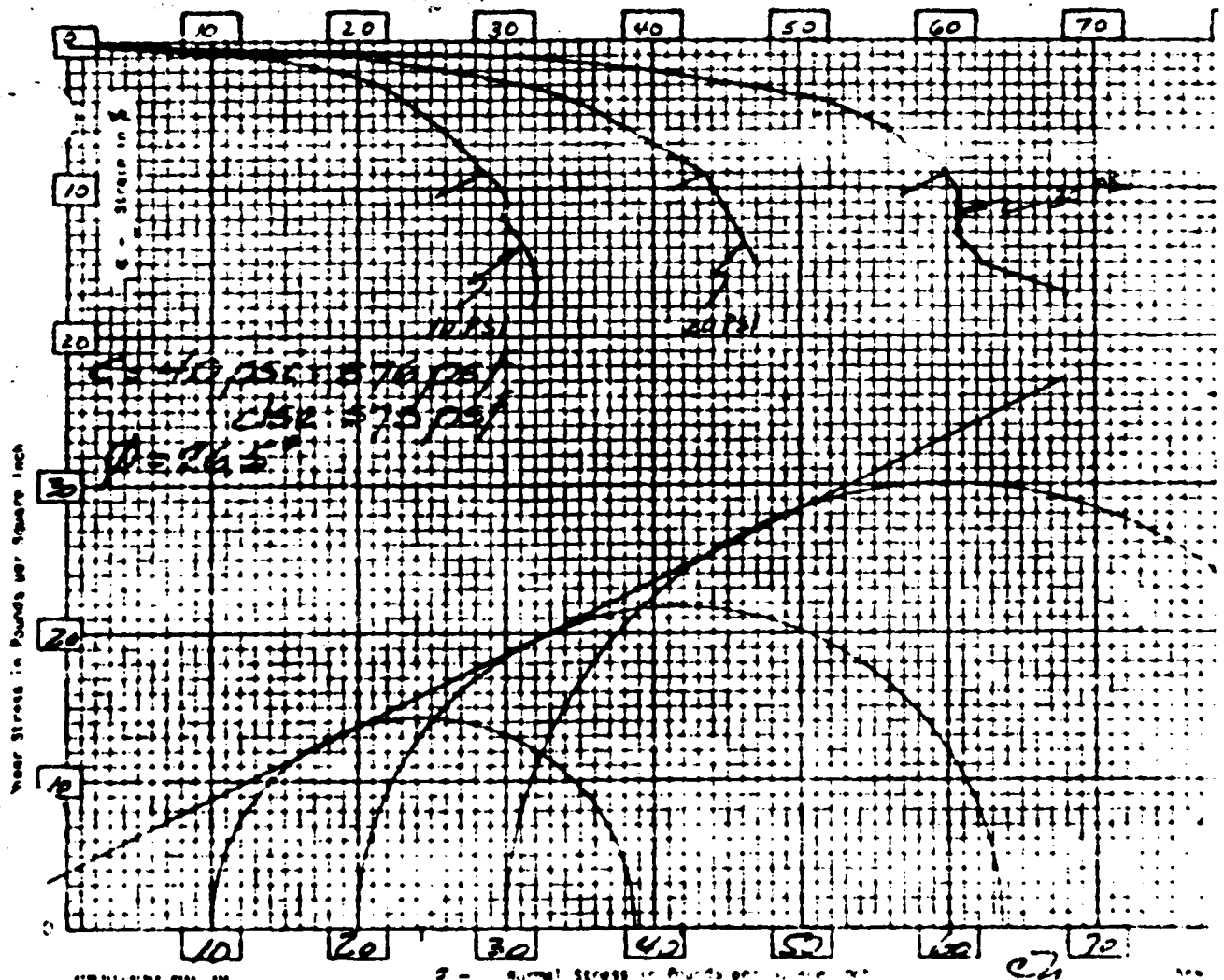
Moisture-Density Data
 Standard ☒ Max. 127.0 pcf
 Modified ☐ Optimum Moisture 10.0 %
 Curve No. 29 of 2
 L.L. 29 P.L. 17 Class CL
 % finer than 0.075 mm 55 COMM 10.0
 Other Factors Affecting Shear:
 % Dispersion 16 % Salt —
 Other: Makes @ Set.

Specifications:
 Specimen: Max. ☒ Consolidated ☐ Drained
 Height — Size — ☐ Unconsolidated ☒ Undrained
 Diameter 1.0 Material —
☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturation
☒ Remolded and Tested at: 95 % of ☒ Standard ☐ Modified
 with — % which is
☐ Lower than ☐ Optimum ☐ Higher than ☒ Saturated
 Optimum —

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content			Lateral Pressure σ_3	Consolidation Data		Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ϵ	Internal Friction ϕ Tan ϕ	Unit Cohesion psi
		Start %	% Sat. Start	End %		Orig. e_0	Final e_c				
121.7	95.8	13.1	98.6	11.9	10	1.1744	0.3399	24.6	9	ϕ	40 psi
120.5	94.9	14.0	96.6	12.0	20	1.3885	1.3313	43.5	9	26.5°	57.5 psi
121.7	95.8	13.7	97.8	11.6	30	1.3764	0.3201	60.0	9		
										Tan ϕ	

$\sigma_1 - \sigma_3$ in Pounds per Square Inch



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

Sample number 62H331

Project TECHNICAL SITE NO. 9

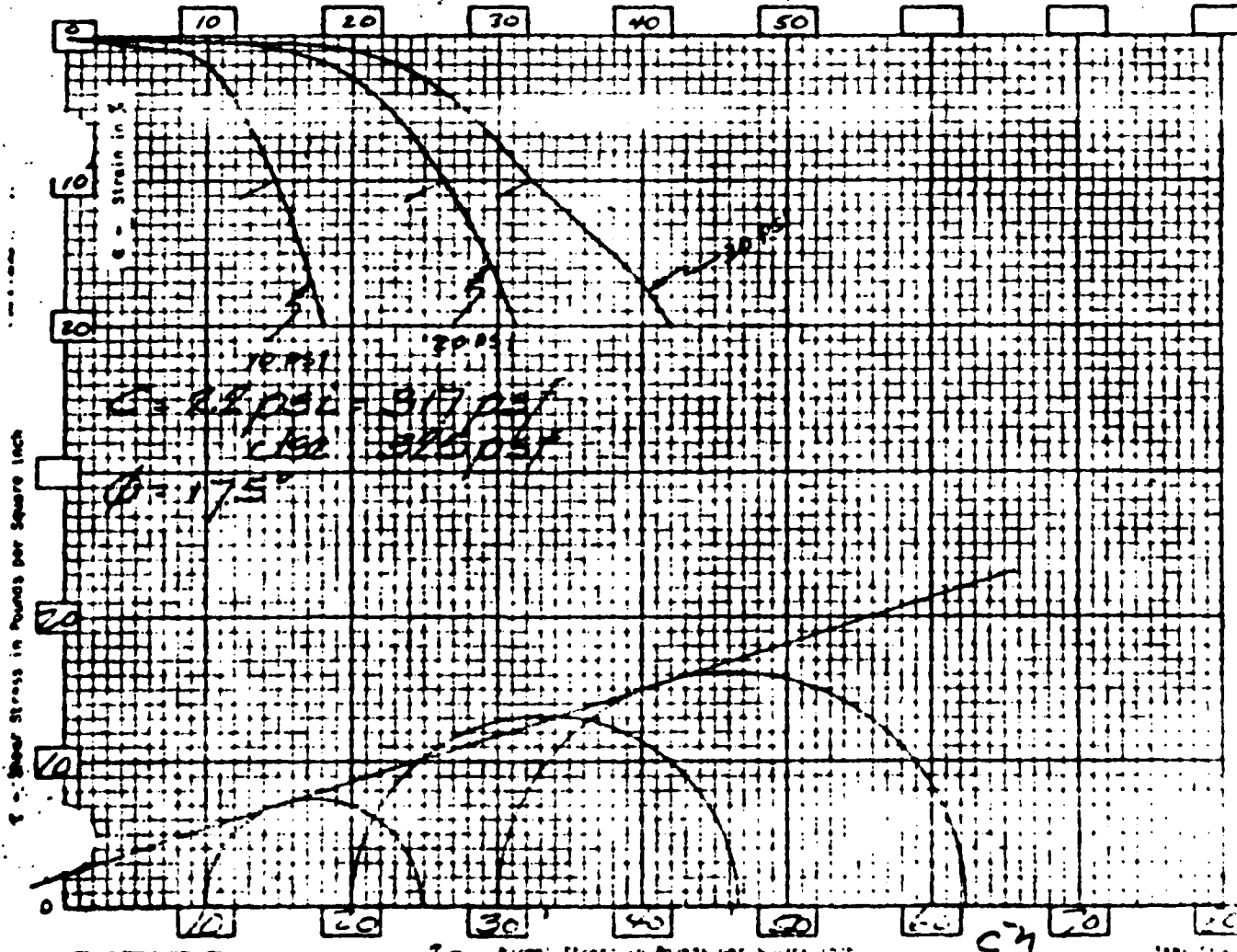
Location NEW YORK

Moisture-Density Data
Standard ☒ Modified ☐
Max. γ 119.0 pcf
Optimum Moisture 13.0 %
Curve No. 1 of 1
L.L. 27.2 P.L. 20.0 Class CL
G finer than 0.002mm 20.00 200 20.00
Other Factors Affecting Shear:
S Dispersion S Salt
Other:

Specifications:
Specimen: Max. ☐ Consolidated ☐ Drained
Height Size ☐ Unconsolidated ☐ Undrained
Diameter 1.5 Material
☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturation
☒ Remolded and Tested at: 95 % of ☒ Standard ☐ Modified
with % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☒ Saturated

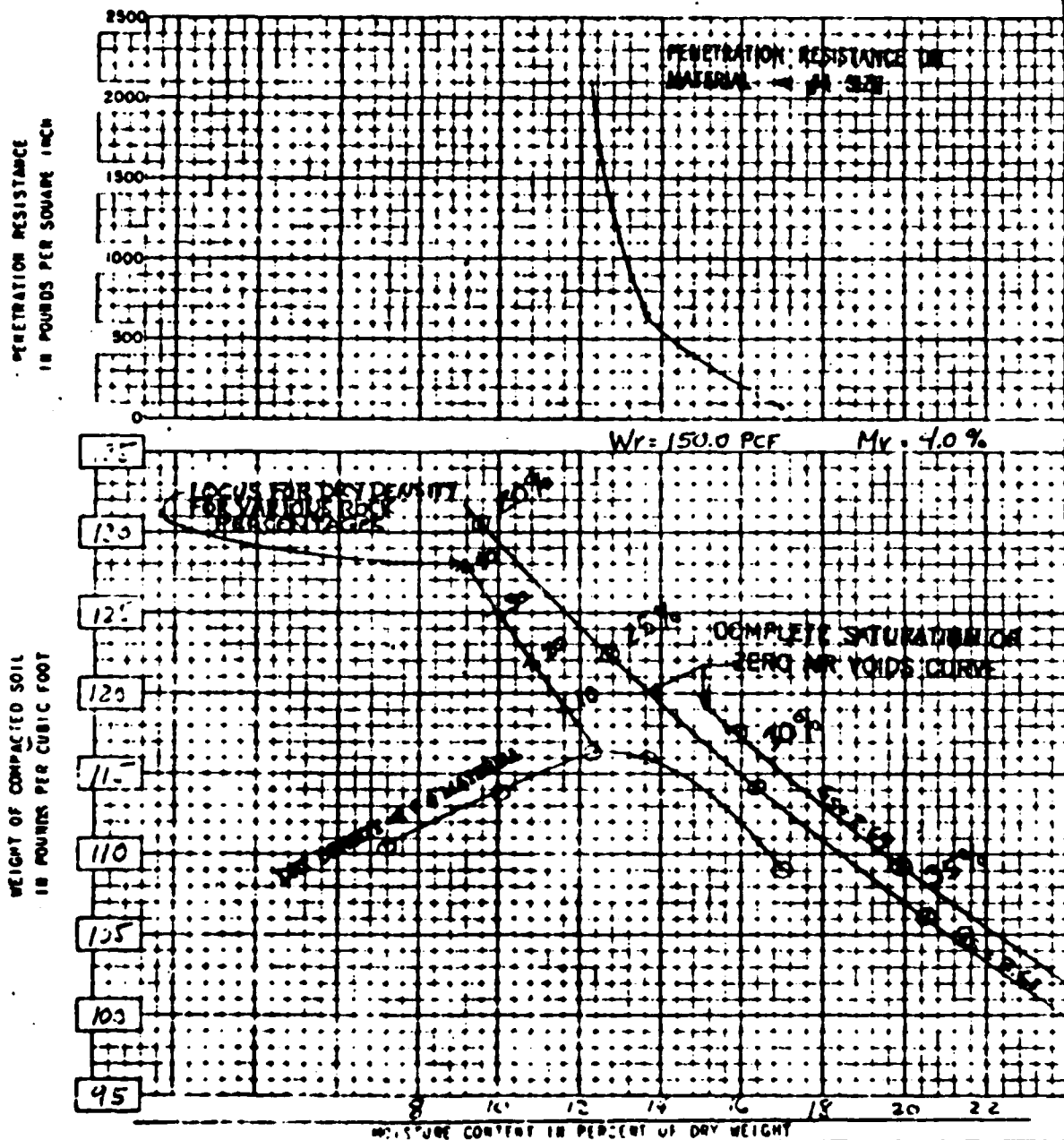
Dry Density γ pcf	S Max. Dry Den.	Moisture Content			Lateral Pressure σ_3	Consolidation Data		Stress at Failure $\sigma_1 - \sigma_3$	Strain at Failure ϵ	Internal Friction ϕ Tan ϕ	Unit Cohesion c
		Start %	S Sat. Start	End %		Orig. e_0	Final e_1				
114.9	96.6	17.0	96.6	15.4	10	0.4782	0.4241	14.3	10	ϕ	2.2 psf
111.1	93.4	17.1	98.1	14.6	20	0.5281	0.4316	26.4	17	17.5°	325 psf
111.1	93.4	17.1	98.1	14.3	30	0.5281	0.4100	32.3	10	Tan ϕ	

σ_1, σ_3 in Pounds per Square Inch



COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 208.1 Lab 62W 330
 Project TECHNICAL MEMO #4 Location NEEDY CORP.
 Sample Location and Depth EM SPWY DEPTH 1-2'



TYPE OF TEST:
☒ Standard Proctor
☐ Modified AASHTO
☐ Other _____

TEST PROCEDURE
 Weight of Rammer 5.5 Lbs.
 Drop 12 Inches
 Lifts 3
 Vol. of Cylinder 1/30 Cu. Ft.

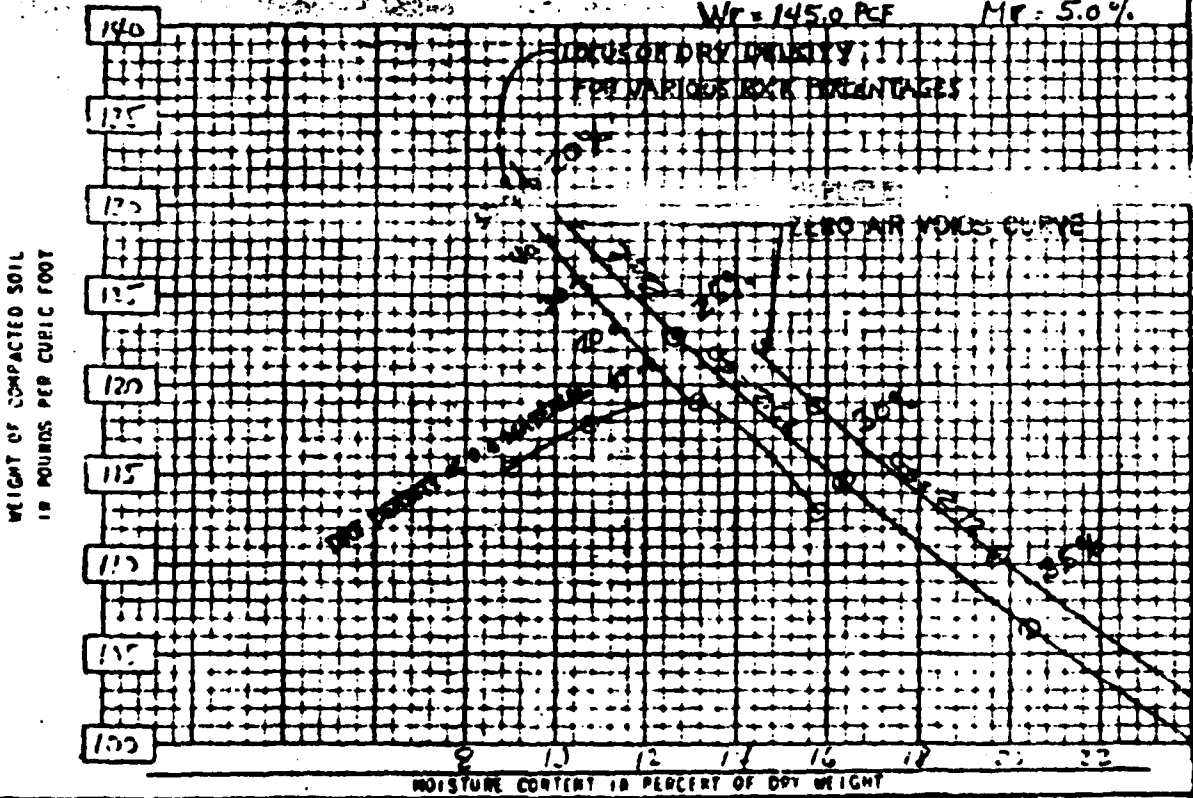
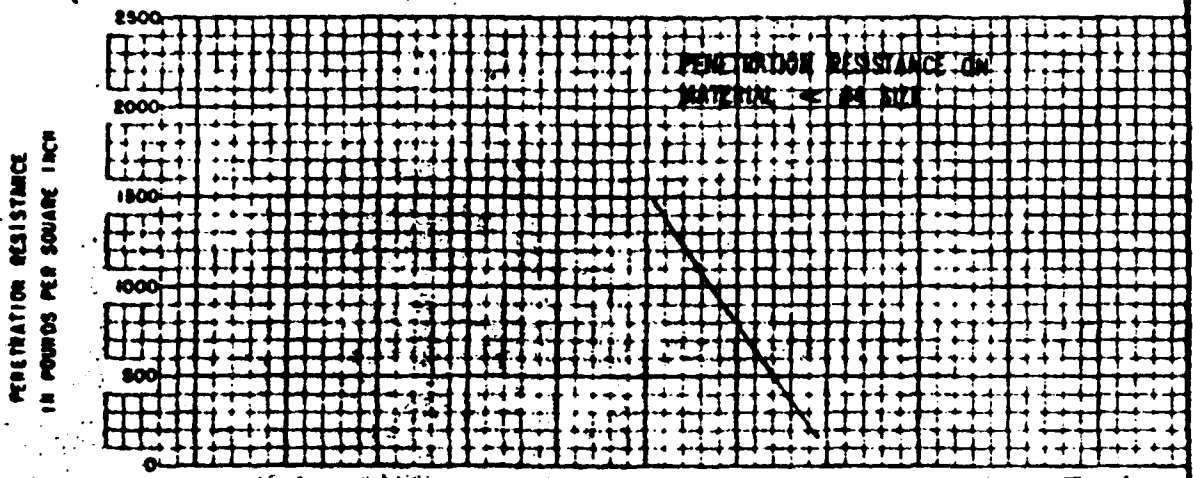
Classification GC-15M

Material compacted represents
60 percent of the sample
 and passed #4 sieve

(Sp. Gr.) 2.61
2.69
 Curve 1 of 4

COMPACTION AND PENETRATION RESISTANCE REPORT

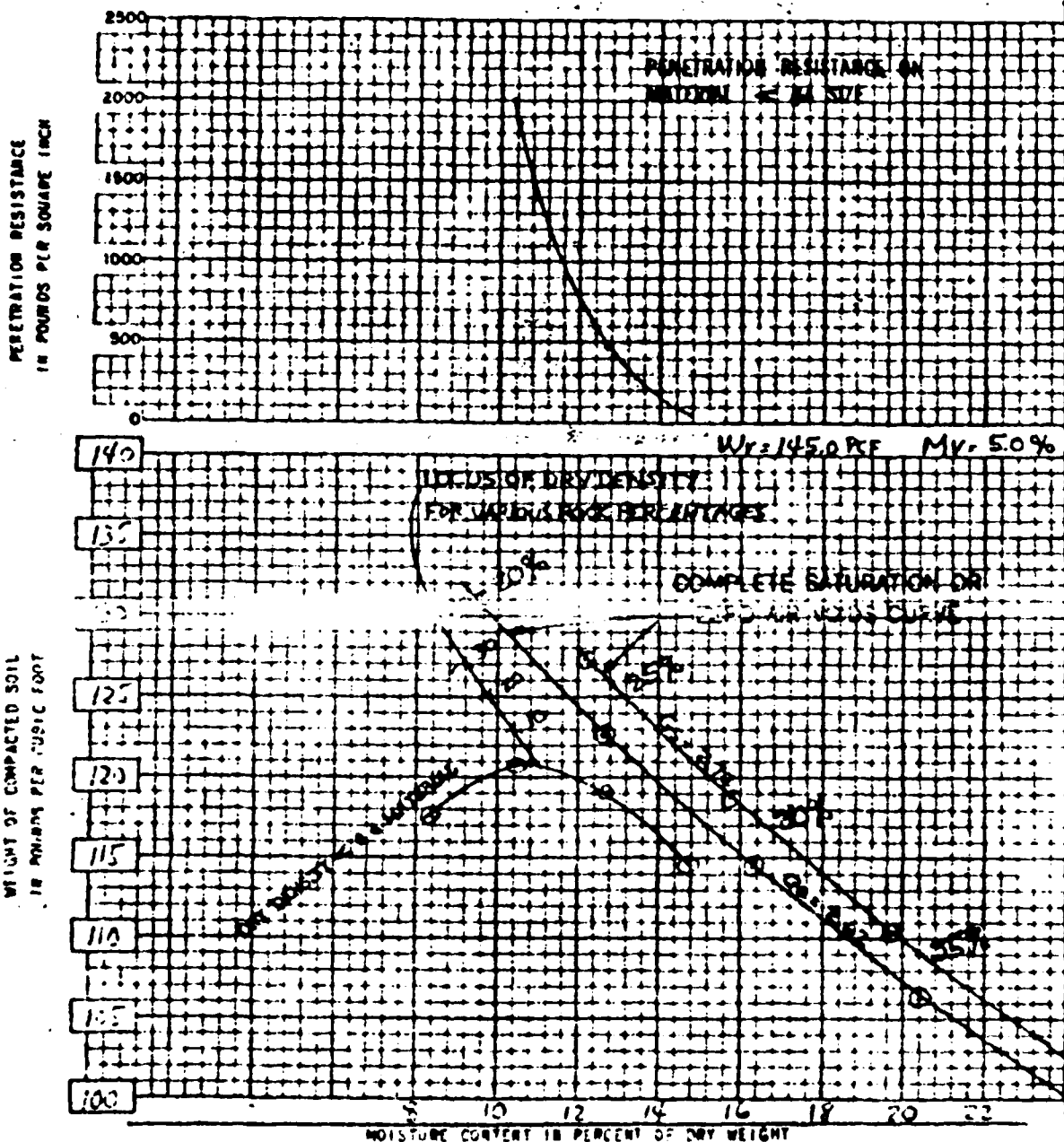
Date _____ Sample No.: Field 213.1 Job G2W 331
 Project 25CHIA CREEK #4 Location NEW 115
 Sample Location and Depth EM SPVY DEPTH 1-9'



TYPE OF TEST <input checked="" type="checkbox"/> Standard Proctor <input type="checkbox"/> Modified AASHTO <input type="checkbox"/> Other _____	TEST PROCEDURE Weight of Hammer <u>5.5</u> lbs. Drop <u>18</u> inches Lifts <u>3</u> Vol. of Cylinder <u>1/2</u> Cu. Ft.	Classification <u>GC-GM</u> Material compacted represents <u>55</u> percent of the sample and passed <u>N#</u> sieve (Sp. Gr.) <u>Gs = 2.65</u> Curve <u>2 of 4</u>
--	--	--

COMPACTION AND PENETRATION RESISTANCE REPORT

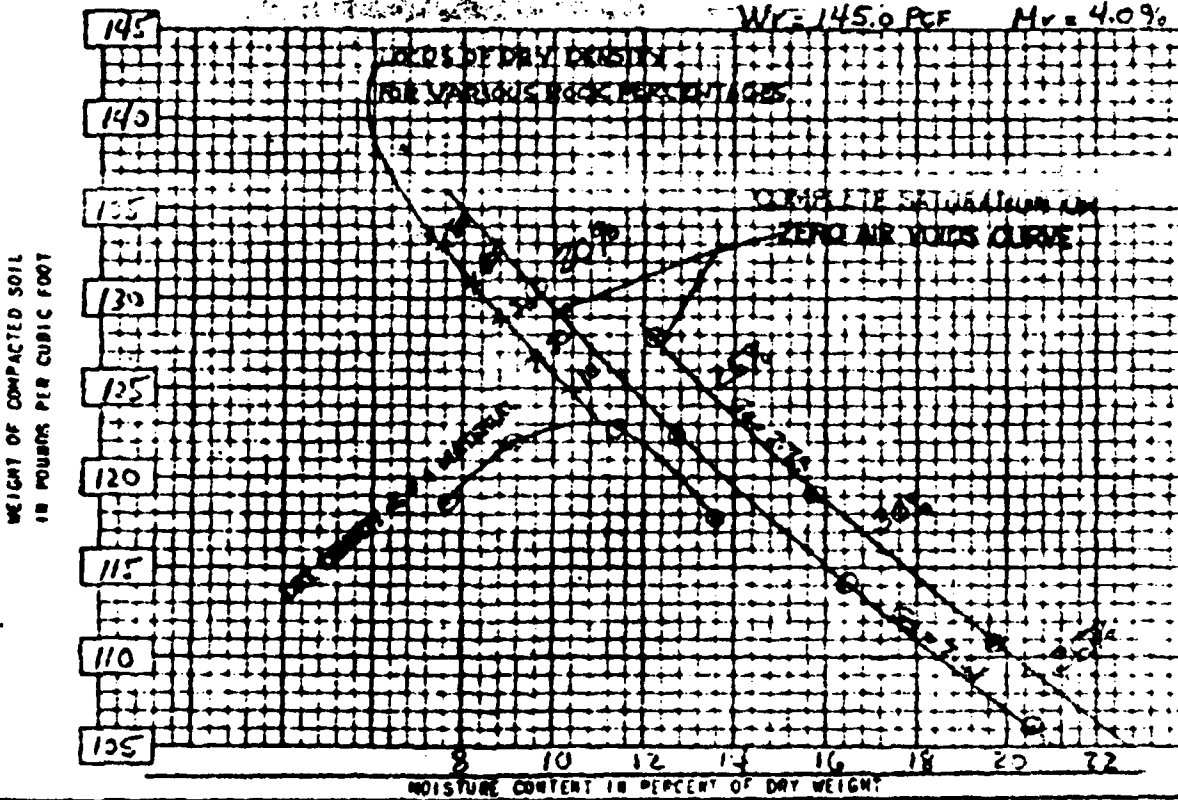
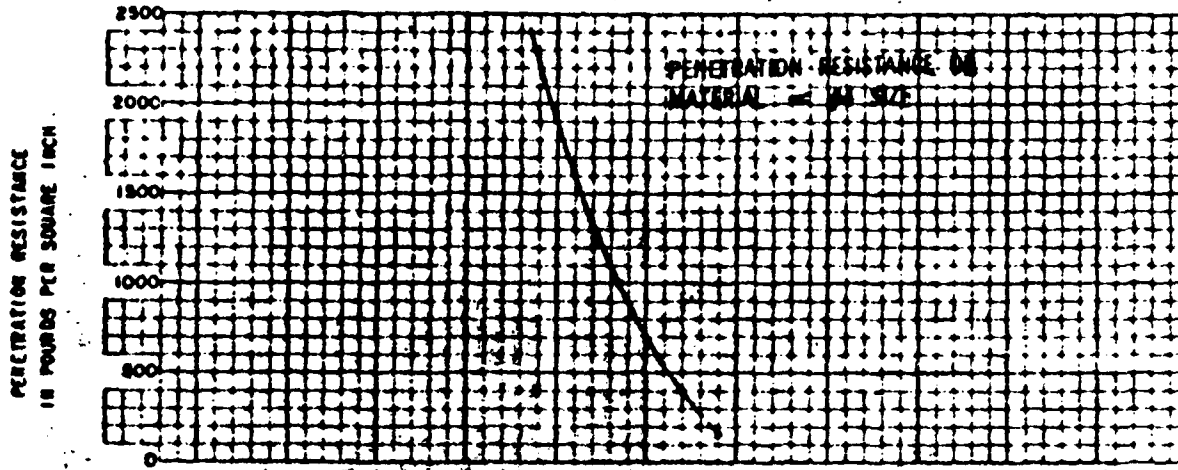
Date _____ Sample No.: Field 216.1 Lab 62W 332
 Project 1.5-14 SPUR #4 Location NEW YORK
 Sample Location and Depth FM SPUR DEPTH 1-2'



TYPE OF TEST <input checked="" type="checkbox"/> Standard Proctor <input type="checkbox"/> Modified AASHO <input type="checkbox"/> Other _____	TEST PROCEDURE weight of Hammer <u>5.5</u> Lbs. Drop <u>12</u> Inches Lift <u>3</u> Vol. of Cylinder <u>1/32</u> Cu. Ft.	Classification <u>GM</u> Material compacted represents <u>62</u> percent of the sample and passed <u>#4</u> sieve (Su. Gr.) <u>100</u> percent Curve <u>3</u> of 4
--	---	--

COMPACTION AND PENETRATION RESISTANCE REPORT

Date Sample No.: Field 103.1 Lab 62W 333
 Project ISCHUA CREEK #4 Location NEW YORK
 Sample Location and Depth 6061:2N DEPTH 1-10'



TYPE OF TEST
☒ Standard Proctor
☐ Modified AASHTO
☐ Other

TEST PROCEDURE
 Weight of Hammer 5.5 lbs.
 Drop 12 inches
 Lifts 3
 Vol. of Cylinder 1/3 Cu. Ft.

Classification GC-GM
 Material compacted represents 50 percent of the sample and passing #4 sieve
 (Sp. Gr.) 2.65
 Curve 4 of 4

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State NEV Project INTELLIGENCE SITE #4

Date 9-5-61 City Waco, TX Made By W. J. 1 Checked By W. J. 1

Method of Analysis Microscopic

Location of Material					89	25020	606M				
Sample No.					7135	624	353				
P ₁					121.8	125.1					
P ₂					133.5	135.0					
P ₃					138.0	136.5					
P ₄					25.5	76.0					
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	
Ten						86.5		285			
E						249		284			
C						255		750			

[illegible][illegible]

STATION

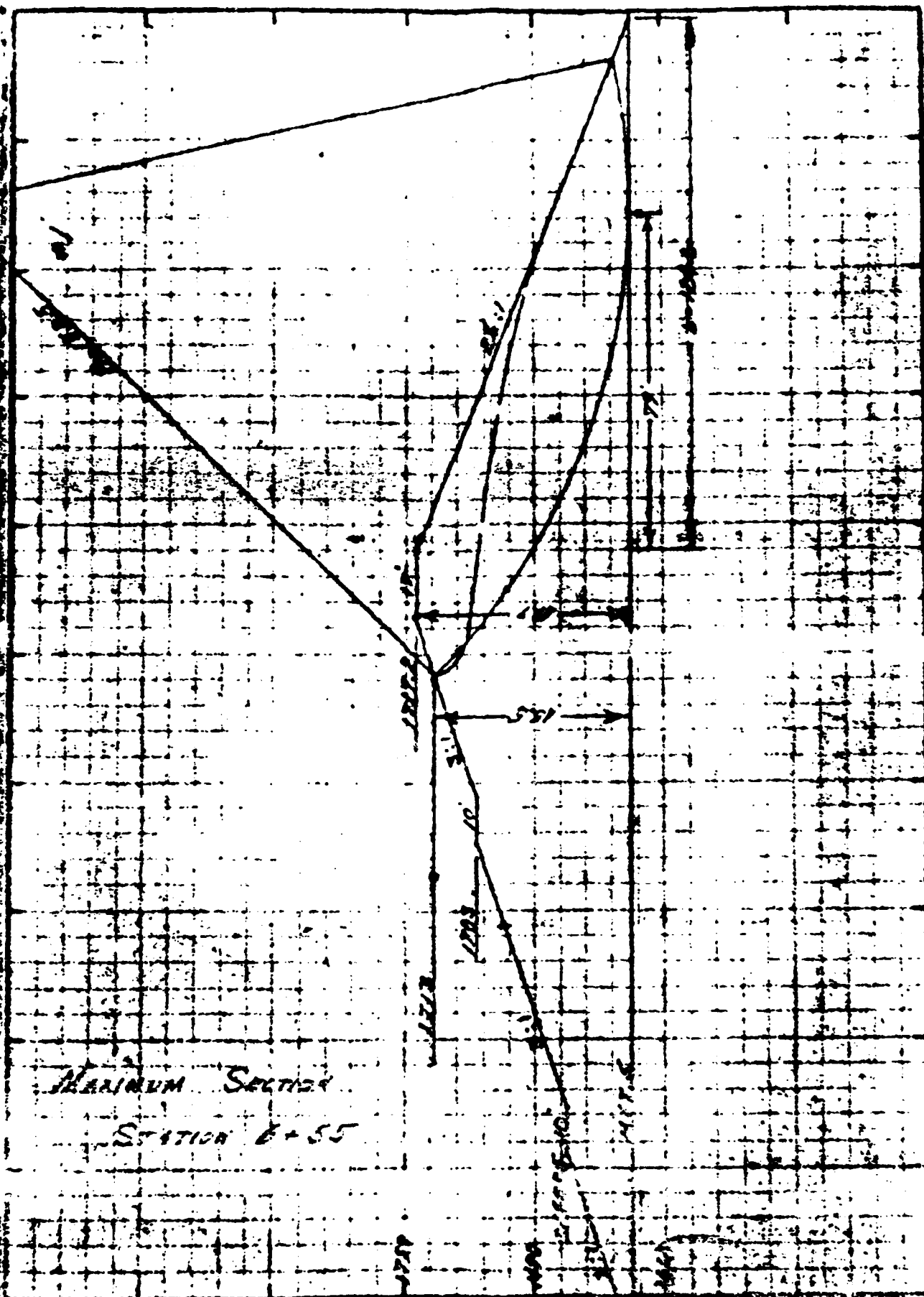
SITE #4

Opt. Sol.

P2

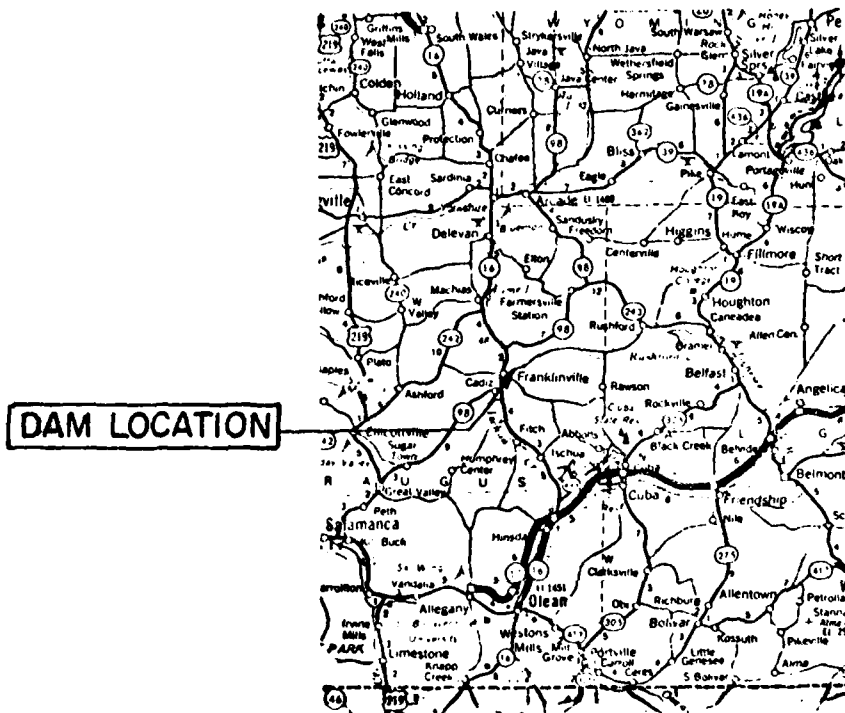
P2

1.92



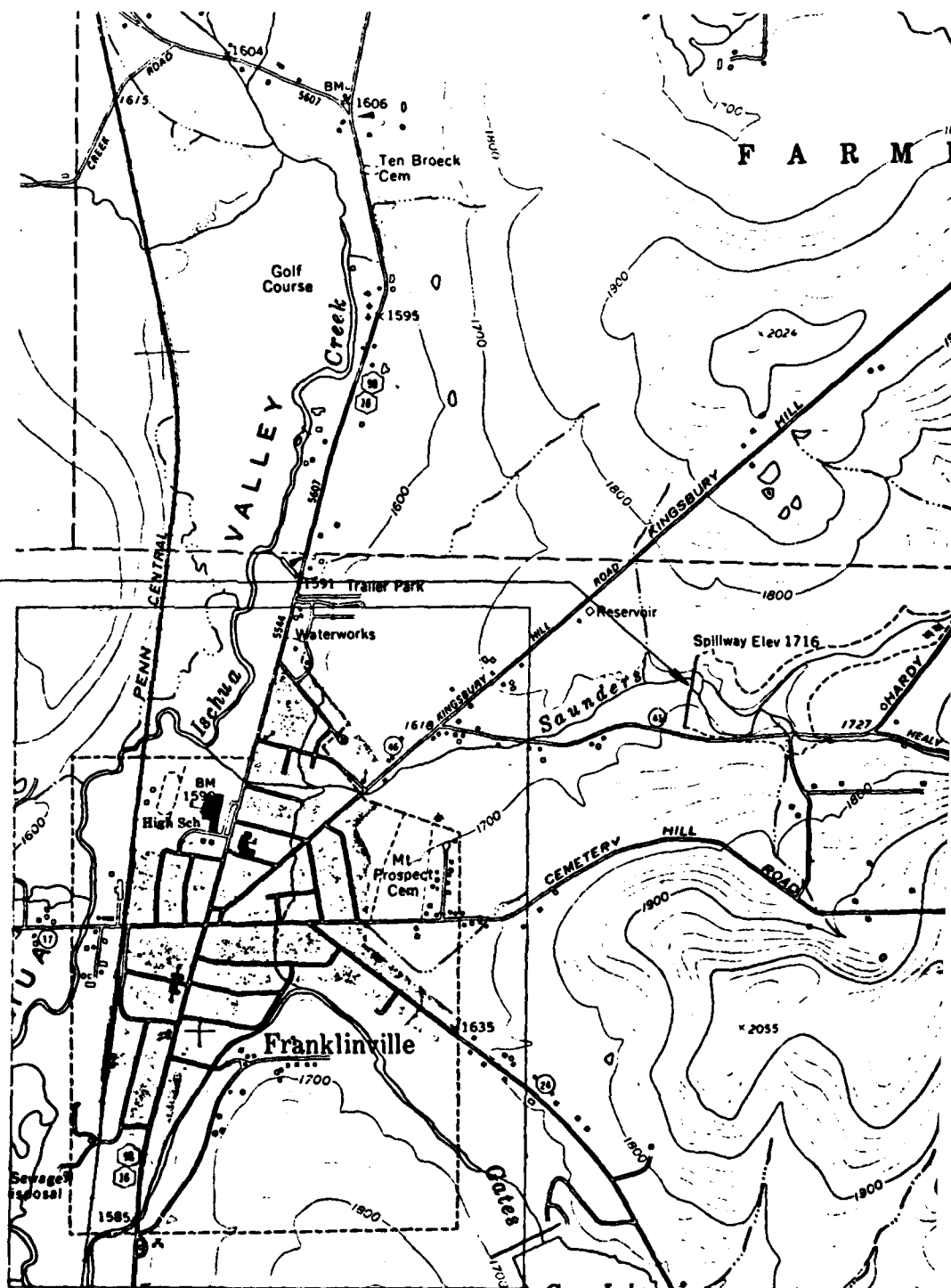
APPENDIX F

AS-BUILT DRAWINGS

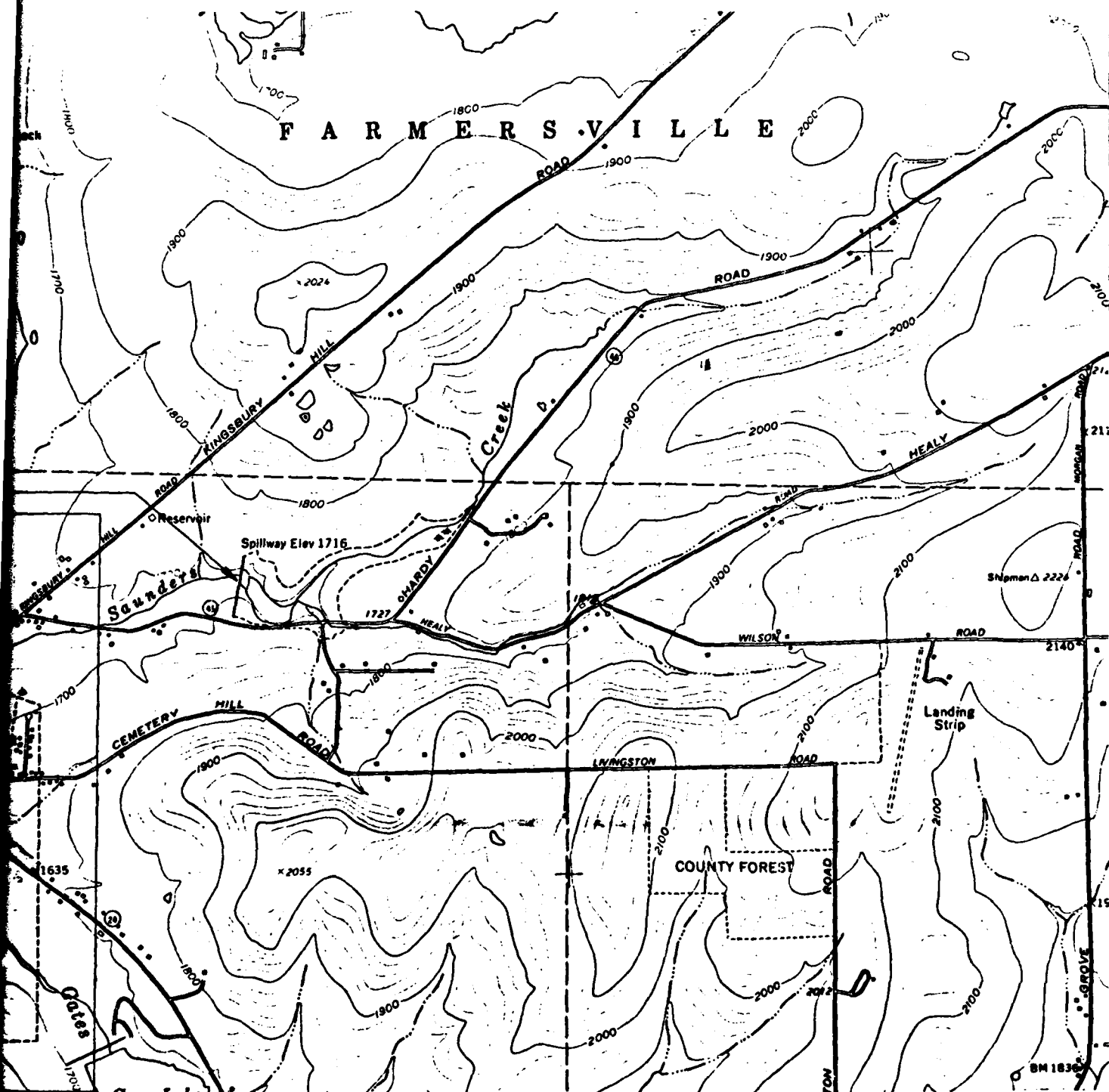


VICINITY MAP
ISCHUA CREEK WATERSHED PROJECT
SITE 4
I.D. NO. N.Y. 626

DAM LOCATION



TOPOGRAPHIC
ISCHUA CREEK WATERSHED
SITE 4
I.D. NO. N.Y. 1



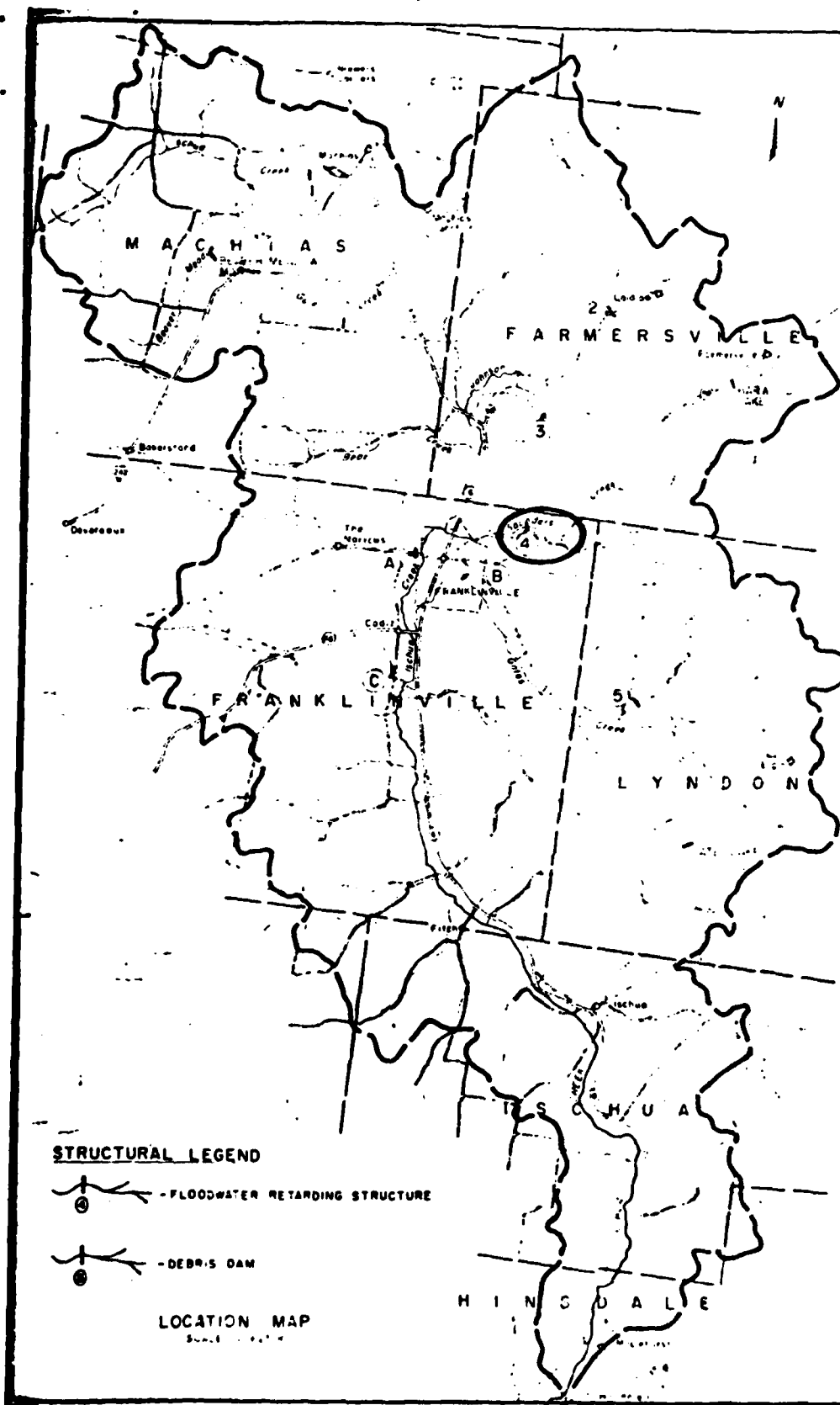
TOPOGRAPHIC MAP
ISCHUA CREEK WATERSHED PROJECT
SITE 4
I.D. NO. N.Y. 626

ISCHUA C FLOO

Flood Sta
DRAINAGE
TOTAL ST
WATER SU
HEIGHT OF
VOLUME O

BUILT UN

ISC



- SHEET 1 COVER SHEET
- SHEET 2 PLAN OF STON
- SHEET 3 PLAN OF DAM
- SHEET 4 PROFILE OF D
- SHEET 5 PROFILES
- SHEET 6 SEEPAGE DRA
- SHEET 7 PLAN-PROFI
- SHEET 8 RISER DETAIL
- SHEET 9 CRADLE - COL
- SHEET 10 TRASH RACK
- SHEET 11 FENCE DETAI

STRUCTURAL LEGEND

- FLOODWATER RETARDING STRUCTURE

- DEBRIS DAM

LOCATION MAP
Scale 1:10,000

ISCHUA CREEK WATERSHED PROJECT

FLOODWATER RETARDING DAM NO. 4

<i>Flood Storage</i>	658	AF
DRAINAGE AREA	2624.	Acres
TOTAL STORAGE	689.	Acre ft.
WATER SURFACE AREA		Acres
HEIGHT OF DAM	51.	Feet
VOLUME OF FILL	102,600.	Cubic Yards

BUILT UNDER THE WATERSHED PROTECTION AND
FLOOD PREVENTION ACT

by

ISCHUA CREEK SMALL WATERSHED DISTRICT

with the assistance of

SOIL CONSERVATION SERVICE

of the

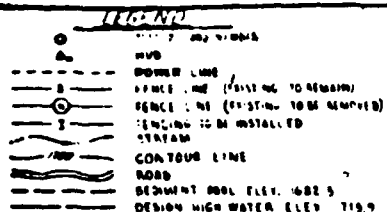
U S DEPARTMENT OF AGRICULTURE

AS BUILT PLAN

SHEET 1 COVER SHEET
SHEET 2 PLAN OF STORAGE AREAS
SHEET 3 PLAN OF DAMSITE
SHEET 4 PROFILE OF DAM
SHEET 5 PROFILES
SHEET 6 SEEPAGE DRAIN DETAILS
SHEET 7 PLAN-PROFILE OF PRINCIPAL SPILLWAY
SHEET 8 RISER DETAILS
SHEET 9 CRADLE - COLLAR AND BENT DETAILS
SHEET 10 TRASH RACK - GATE WELL - MISC DETAILS
SHEET 11 FENCE DETAILS

AS BUILT

ISCHUA CREEK WATERSHED PROJECT	
NEW YORK STATE DEPARTMENT OF AGRICULTURE	
DIVISION OF SOIL CONSERVATION	
COVER SHEET	
U S DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
RECORD DRAWING	DATE: 10/1/54
BY: [Signature]	
CHECKED: [Signature]	
NY-504	



CURVE 2 INFORMATION

STATION	CHORD	DEFLECTION
1	15.00	15.00
2	15.00	15.00
3	15.00	15.00
4	15.00	15.00
5	15.00	15.00
6	15.00	15.00
7	15.00	15.00
8	15.00	15.00
9	15.00	15.00
10	15.00	15.00

CURVE 3 INFORMATION

STATION	CHORD	DEFLECTION
1	15.00	15.00
2	15.00	15.00
3	15.00	15.00
4	15.00	15.00
5	15.00	15.00
6	15.00	15.00
7	15.00	15.00
8	15.00	15.00
9	15.00	15.00
10	15.00	15.00

CURVE 4 INFORMATION

STATION	CHORD	DEFLECTION
1	15.00	15.00
2	15.00	15.00
3	15.00	15.00
4	15.00	15.00
5	15.00	15.00
6	15.00	15.00
7	15.00	15.00
8	15.00	15.00
9	15.00	15.00
10	15.00	15.00

STA. DATA

STA.	ELEV.
1	1719.90
2	1719.90
3	1719.90
4	1719.90
5	1719.90
6	1719.90
7	1719.90
8	1719.90
9	1719.90
10	1719.90

GENERAL NOTES:

- ALL COMPACTED FILL SHALL BE AS DIRECTED BY THE ENGINEER.
- AREA UNDER THE DAM, BORROW AREA, SEDIMENT POOL & EMERGENCY SPILLWAY TO BE CLEARED & GRUBBED (3) ACRES (1:1).
- TOPSOIL REMOVED & STOCKPILED DURING CONSTRUCTION OPERATION, UNDER THE DAM, BORROW AREA & EMERGENCY SPILLWAY SHALL BE RELOADED ON THE FILL, EMERGENCY SPILLWAY & BORROW AREA, AS DIRECTED BY THE ENGINEER.

SOIL DATA FOR BORROW AREAS

(DATE OF GEOLOGICAL INVESTIGATION - MAY 61)
(UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION)
(NOT BY LABORATORY ANALYSIS)

TP-101 ELEV. 17450

TP-102 ELEV. 17370

TP-103 ELEV. 17180

TP-104 ELEV. 17400

TP-105 ELEV. 17460

TP-106 ELEV. 17490

TP-108 ELEV. 17390

TP-109 ELEV. 17270

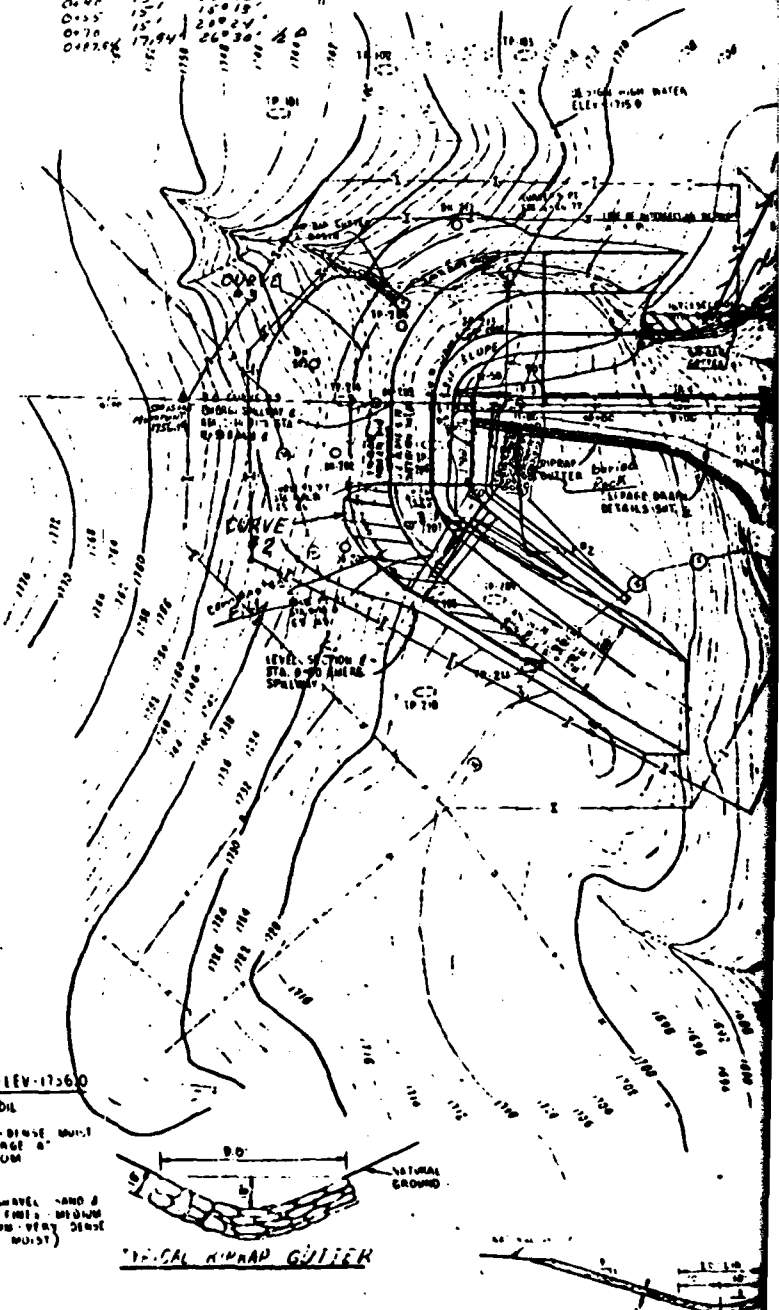
TP-206 ELEV. 17180

TP-207 ELEV. 17160

TP-209 ELEV. 17130

TP-211 ELEV. 17110

TP-216 ELEV. 17360



NOTE: IF DIMENSION OF RIPRAP USED WILL BE NO LESS THAN 8" WITH LONG DIMENSION PARALLEL PERPENDICULAR TO THE LINE OF FLOW

PROFILE OF RIPRAP GUTTER
 1. RIPRAP SHALL BE PLACED IN THE GUTTER OF THE DAM AND SHALL BE 10' WIDE AT THE HEAD OF THE GUTTER.
 2. THE RIPRAP SHALL BE PLACED IN THE GUTTER OF THE DAM AND SHALL BE 10' WIDE AT THE HEAD OF THE GUTTER.

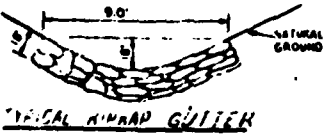
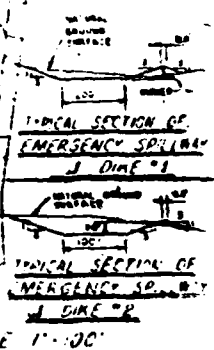
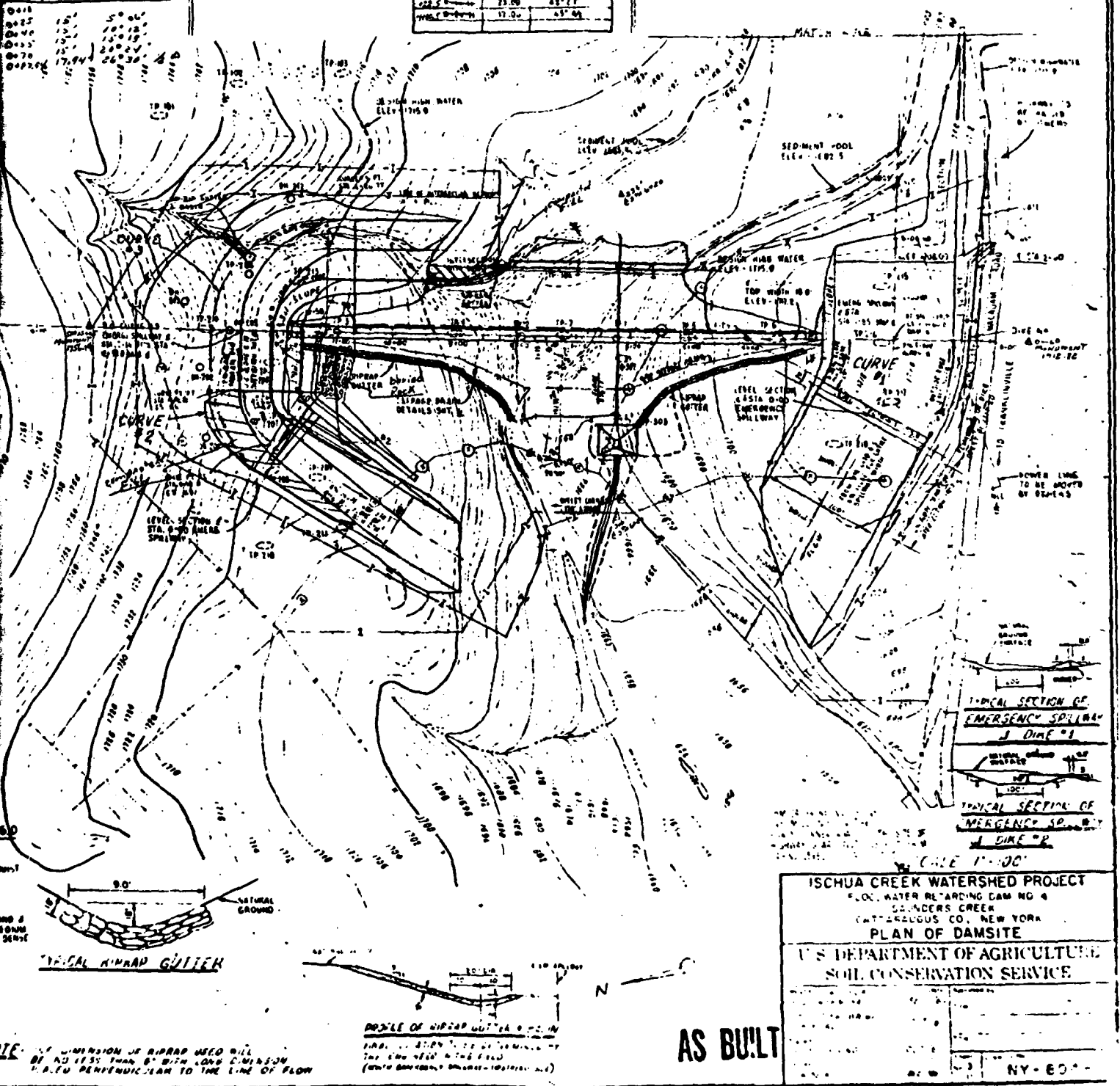
STATION	CHORD	DEFLECTION
10+00	15.00	15° 00'
10+25	25.00	25° 00'
10+50	35.00	35° 00'
10+75	45.00	45° 00'
11+00	55.00	55° 00'
11+25	65.00	65° 00'
11+50	75.00	75° 00'
11+75	85.00	85° 00'
12+00	95.00	95° 00'

CURVE 3 INFORMATION	
Δ	90° 00'
R	47.44'
L	151.86'
T	27.46'
E	135.00'
M	50.97'
N	30.56'
L.C.	172.42'

STATION	CHORD	DEFLECTION
12+00	15.00	15° 00'
12+25	25.00	25° 00'
12+50	35.00	35° 00'
12+75	45.00	45° 00'
13+00	55.00	55° 00'
13+25	65.00	65° 00'
13+50	75.00	75° 00'
13+75	85.00	85° 00'
14+00	95.00	95° 00'

CURVE 4 INFORMATION	
Δ	90° 00'
R	47.44'
L	151.86'
T	27.46'
E	135.00'
M	50.97'
N	30.56'
L.C.	172.42'

STATION	CHORD	DEFLECTION
14+00	15.00	15° 00'
14+25	25.00	25° 00'
14+50	35.00	35° 00'
14+75	45.00	45° 00'
15+00	55.00	55° 00'
15+25	65.00	65° 00'
15+50	75.00	75° 00'
15+75	85.00	85° 00'
16+00	95.00	95° 00'



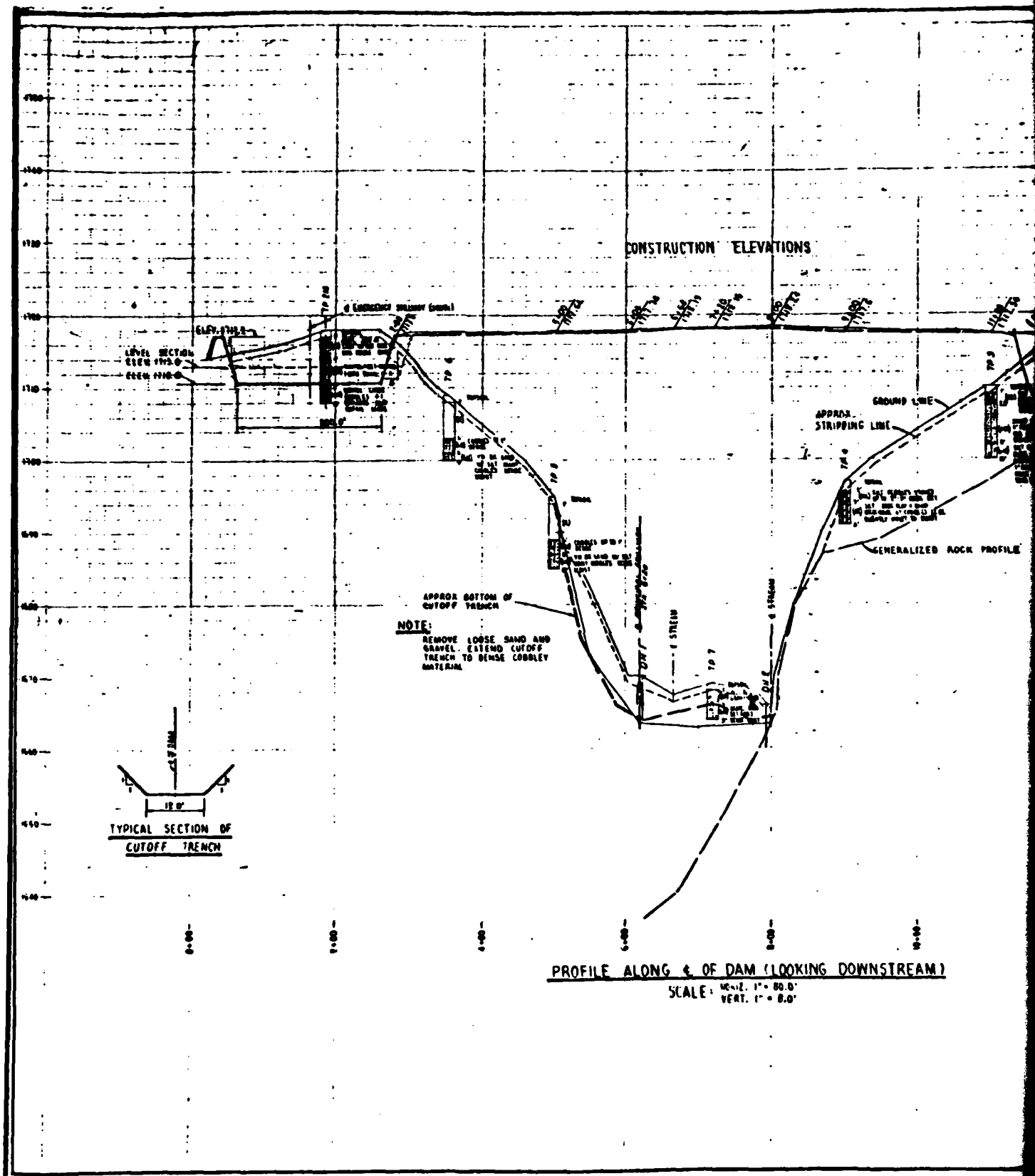
PROFILE OF RIPRAP GUTTER 4'-0" IN
 DIA. 10' 0" LONG 10' 0" WIDE
 (SEE PLAN FOR LOCATION OF
 THE GUTTER IN THE FIELD)
 (SEE DAM SITE PLAN FOR LOCATION OF GUTTER)

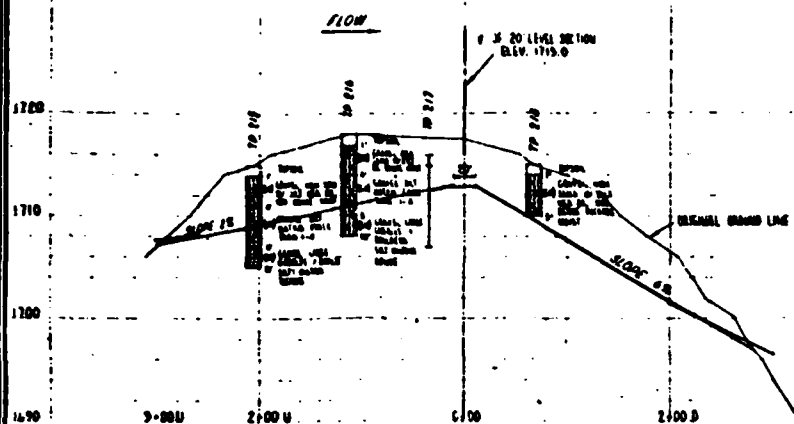
AS BUILT

ISCHIA CREEK WATERSHED PROJECT
 FLOOD WATER RETARDING DAM NO. 4
 SANDERS CREEK
 CATTARAUGUS CO., NEW YORK
PLAN OF DAMSITE

U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

NY-60



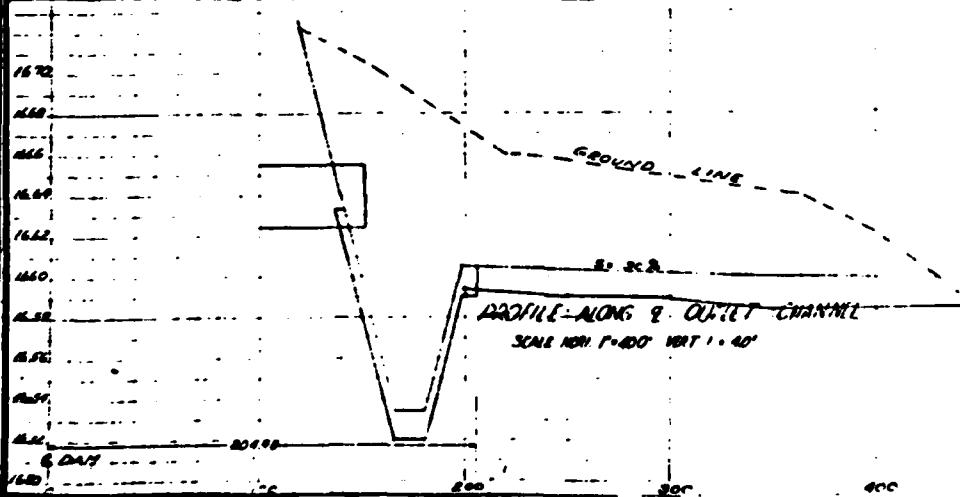


PROFILE ALONG 8 EMERGENCY SPILLWAY (SOUTH)
SCALE HORIZ. 1" = 80' VERT. 1" = 40'

TP-217
REV-176
TYPICAL
SECTION
OF
EMERGENCY
SPILLWAY
(SOUTH)

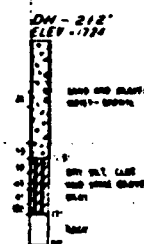
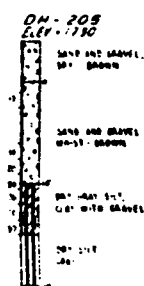
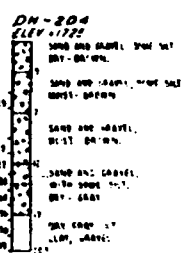
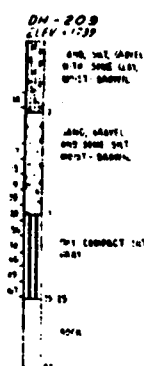
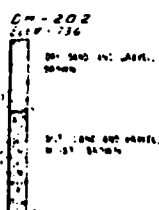
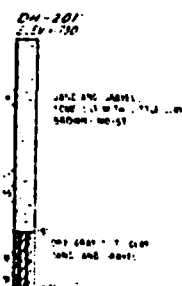
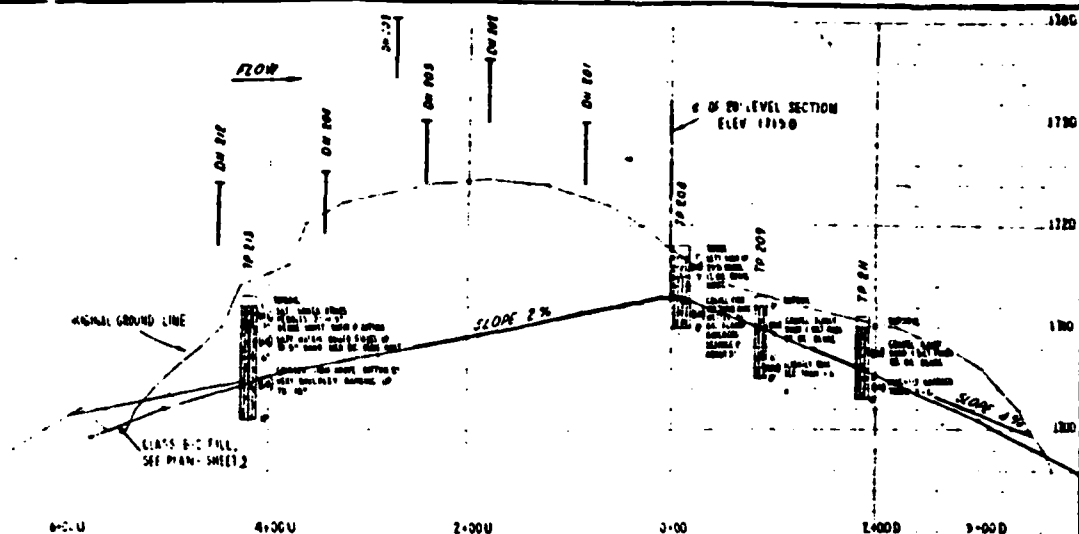
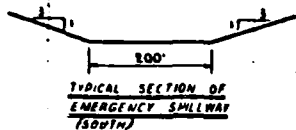
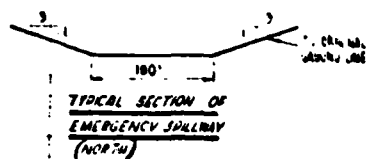
DM-201
REV-750
TYPICAL
SECTION
OF
EMERGENCY
SPILLWAY
(NORTH)

DM-202
REV-756
TYPICAL
SECTION
OF
EMERGENCY
SPILLWAY
(NORTH)



PROFILE ALONG 8 OUTLET CHANNEL
SCALE HORIZ. 1" = 80' VERT. 1" = 40'

TYPICAL SECTION OF
OUTLET CHANNEL

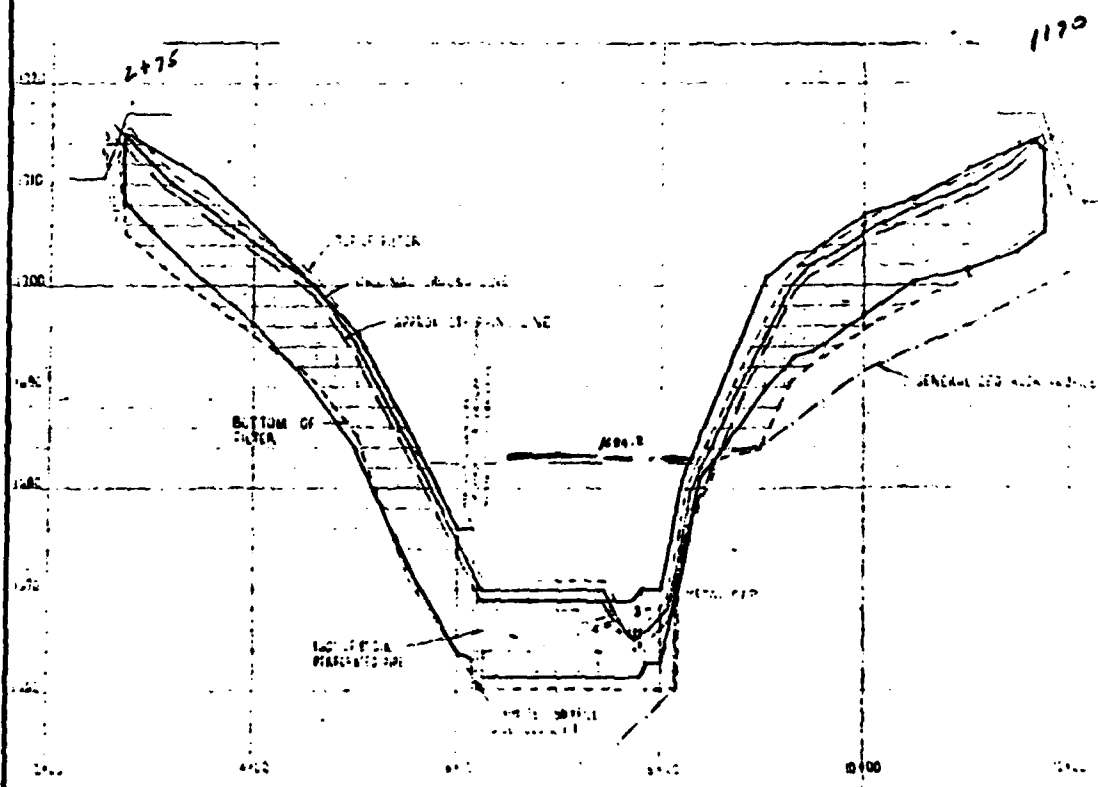
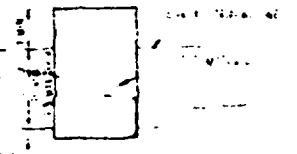
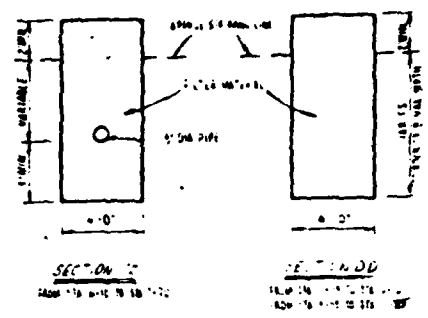
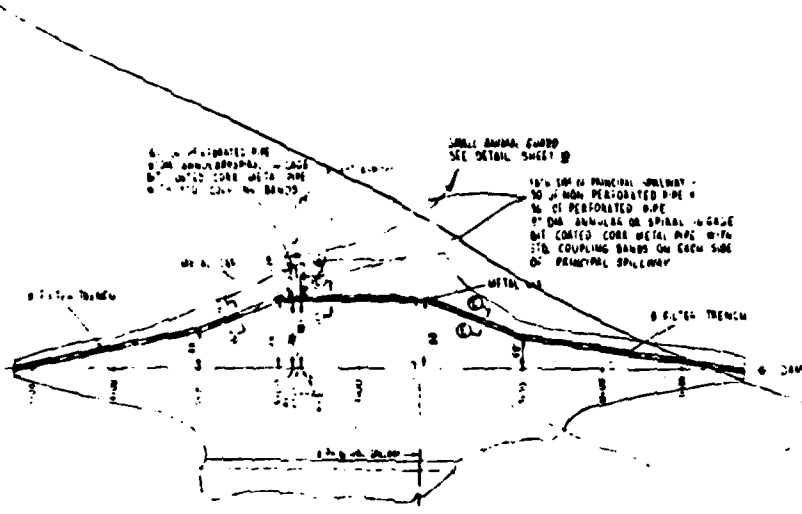


DATE OF SOIL INVESTIGATION TEST P.T. MAY 64
DATE OF SOIL INVESTIGATION TEST P.T. MAY 64
INITIALS AND CLASSIFICATIONS BY VISUAL INSPECTION.

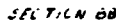
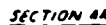
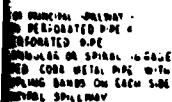


AS BUILT

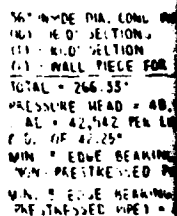
ISCHUA CREEK WATERSHED PROJECT	
U.S. DEPARTMENT OF AGRICULTURE	
SOIL CONSERVATION SERVICE	
DATE: SEPTEMBER 1964	BY: [Signature]
NY-604-P	



PROFILE ALONG E OF FILTER TRENCH - LOOKING DOWNSTREAM



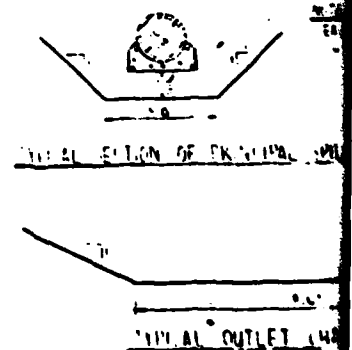
NY - 604



DATE OF GEOLOGICAL INVESTIGATION - MAY 1961
UNIFIED SOIL CLASSIFICATION BY VISUAL INSPECTION,
NOT BY LABORATORY ANALYSIS.

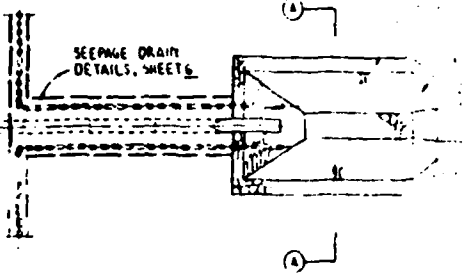
TP - 304 ELEV

1561

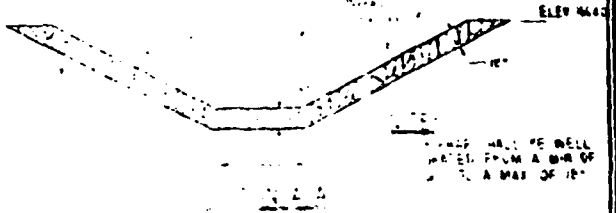


PLAN VIEW
SCALE 1" = 20'

PLAN VIEW
SCALE 1" = 20'



36" WIDE DIA. CONG. WATER PIPE
 (1) 16.0' SECTION
 (2) 11.0' SECTION
 (3) WALL PIECE FOR 12" WALL
 TOTAL = 266.33'
 PRESSURE HEAD = 48.9'
 AL = 42,542 PER LIN. FT. BASED ON
 C.D. OF 42.25'
 MIN. 3" EDGE BEARING LENGTH FOR 30" DIA.
 MIN. PRESTRESSED PIPE = 14.174' PER LIN. FT.
 MIN. 3" EDGE BEARING LENGTH FOR 12" DIA.
 PRESTRESSED PIPE = 11.07' PER LIN. FT.

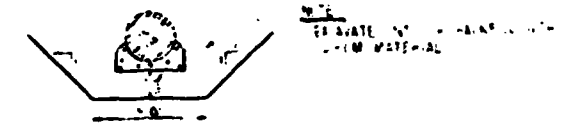


NO.	WATER WALL PIECE	WATER PIPE
1	0	16.0
2	0	11.0
3	26	11.0
4	42	11.0
5	16	11.0
6	16	11.0
7	16	11.0
8	16	11.0
9	16	11.0
10	16	11.0
11	16	11.0
12	16	11.0
13	16	11.0
14	16	11.0
15	16	11.0
16	16	11.0
17	16	11.0
18	16	11.0
19	16	11.0
20	16	11.0
21	16	11.0
22	16	11.0
23	16	11.0
24	16	11.0
25	16	11.0
26	16	11.0
27	16	11.0
28	16	11.0
29	16	11.0
30	16	11.0
31	16	11.0
32	16	11.0
33	16	11.0
34	16	11.0
35	16	11.0
36	16	11.0
37	16	11.0
38	16	11.0
39	16	11.0
40	16	11.0
41	16	11.0
42	16	11.0
43	16	11.0
44	16	11.0
45	16	11.0
46	16	11.0
47	16	11.0
48	16	11.0
49	16	11.0
50	16	11.0

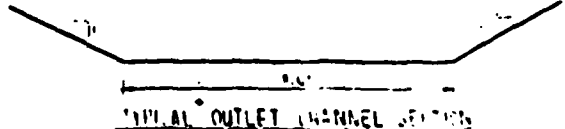
SPILLWAY WALL PIECE
 VARIATION IN ELEVATION
 OF THE SPILLWAY WALL
 IN FEET

NO.	WATER WALL PIECE	WATER PIPE
1	0	16.0
2	0	11.0
3	26	11.0
4	42	11.0
5	16	11.0
6	16	11.0
7	16	11.0
8	16	11.0
9	16	11.0
10	16	11.0
11	16	11.0
12	16	11.0
13	16	11.0
14	16	11.0
15	16	11.0
16	16	11.0
17	16	11.0
18	16	11.0
19	16	11.0
20	16	11.0
21	16	11.0
22	16	11.0
23	16	11.0
24	16	11.0
25	16	11.0
26	16	11.0
27	16	11.0
28	16	11.0
29	16	11.0
30	16	11.0
31	16	11.0
32	16	11.0
33	16	11.0
34	16	11.0
35	16	11.0
36	16	11.0
37	16	11.0
38	16	11.0
39	16	11.0
40	16	11.0
41	16	11.0
42	16	11.0
43	16	11.0
44	16	11.0
45	16	11.0
46	16	11.0
47	16	11.0
48	16	11.0
49	16	11.0
50	16	11.0

PROFILE OF PRINCIPAL SPILLWAY DAM & ELEV. 0-1000
 SCALE: 1" = 20.0' HORIZ.
 1" = 10' VERT.



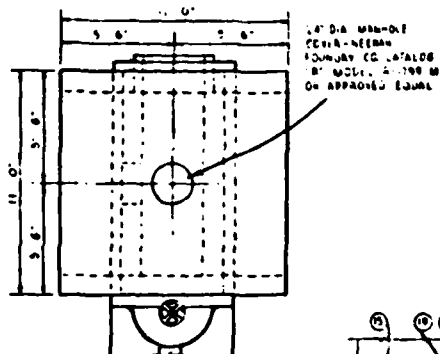
PLAN SECTION OF PRINCIPAL SPILLWAY DAM



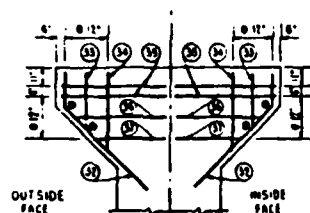
PLAN SECTION OF PRINCIPAL SPILLWAY DAM

AS BUILT

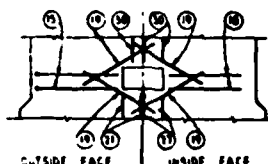
SCHLA CREEK WATERSHED PROJECT
 PLAN PROFILE OF PRINCIPAL SPILLWAY
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 PROJECT NO. 1-1000
 DRAWING NO. 1-1000
 DATE 1-1-60
 BY 1-1-60
 CHECKED 1-1-60
 APPROVED 1-1-60



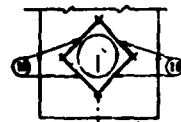
PLAN



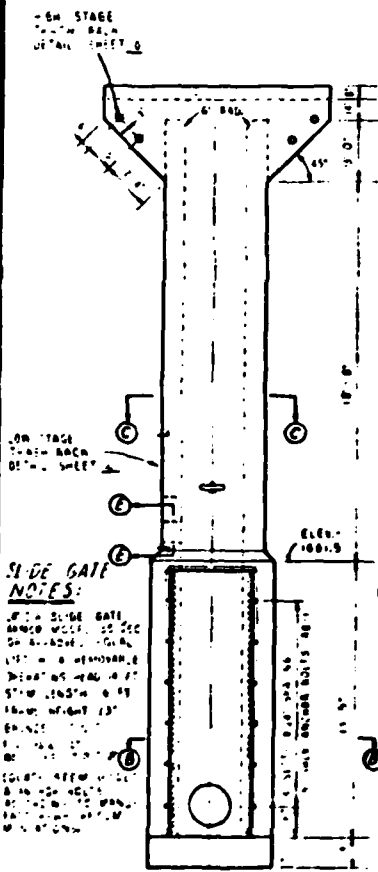
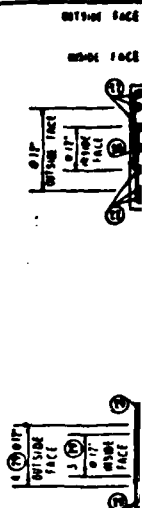
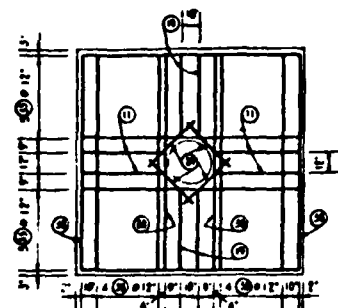
SECTION F-F



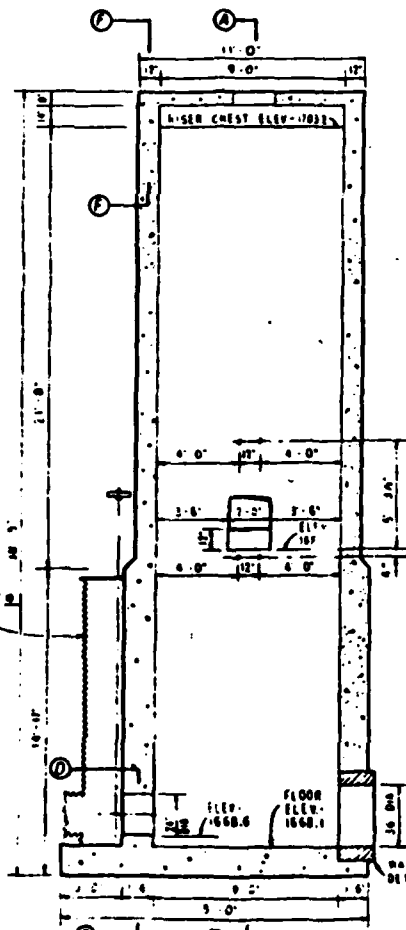
SECTION E-E



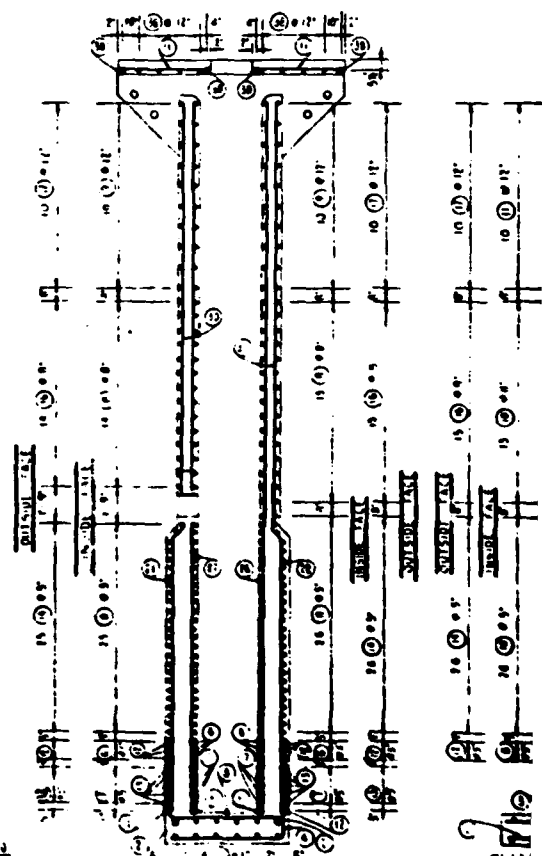
SECTION D-D



SIDE GATE ELEVATION



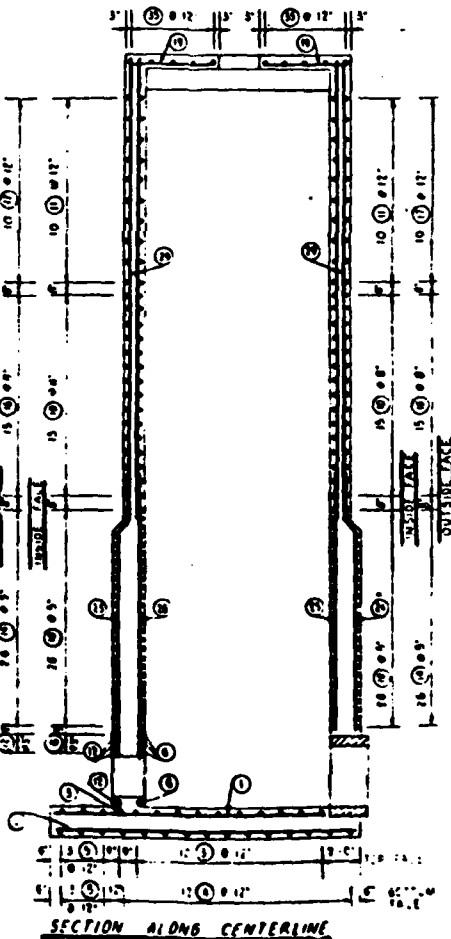
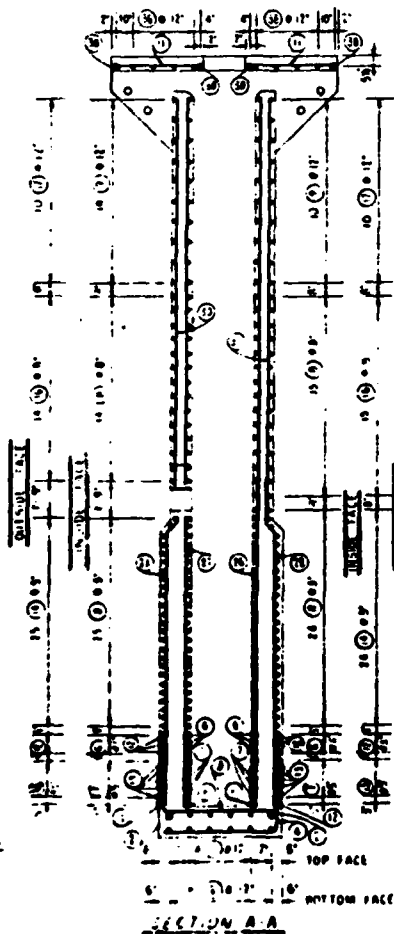
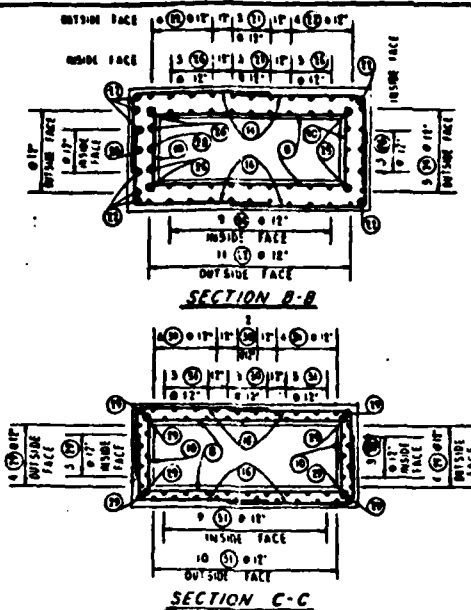
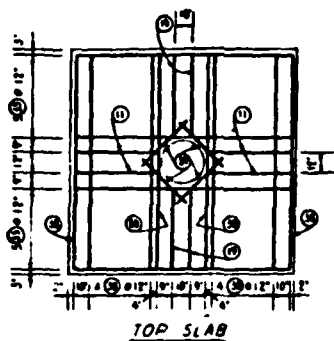
SECTION ON CENTERLINE



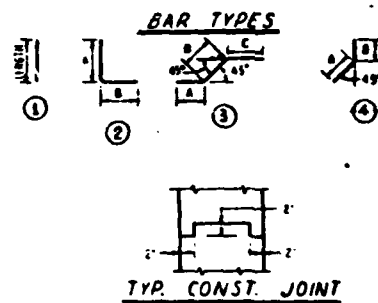
SECTION A-A

SLIDE GATE NOTES:
1. SLIDE GATE
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100. SLIDE GATE

STRUCTURAL 3 STEEL DETAILS OF RISER



STEEL SCHEDULE									
NO.	DESCRIPTION	QTY	SIZE	UNIT	WEIGHT	QTY	WEIGHT	QTY	WEIGHT
1	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
2	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
3	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
4	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
5	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
6	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
7	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
8	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
9	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
10	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
11	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
12	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
13	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
14	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
15	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
16	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
17	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
18	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
19	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
20	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
21	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
22	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
23	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
24	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
25	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
26	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
27	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
28	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
29	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
30	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
31	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
32	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
33	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
34	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
35	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
36	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
37	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
38	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00
39	1" x 12" x 12"	1	1"	12"	12"	1	12.00	1	12.00

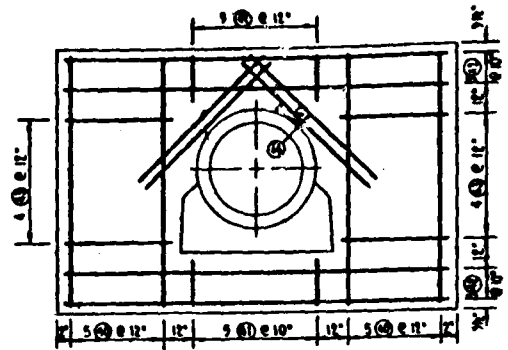
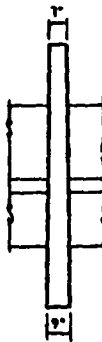
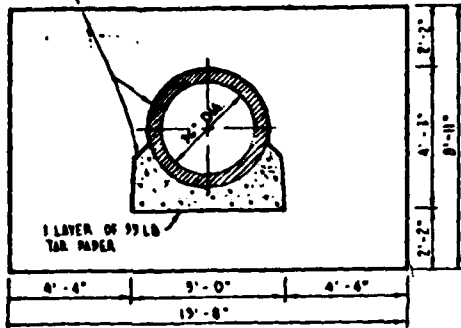


AS BUILT

SCALE 1/4" = 1'-0"

ISCHUA CREEK WATERSHED PROJECT FLOODWATER RETARDING DAM NO. 4 SAUNDERS CREEK CATTARAUGUS CO., NEW YORK RISER DETAILS	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
DRAWN BY: [] CHECKED BY: [] DATE: []	NY-804-5

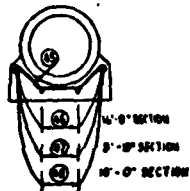
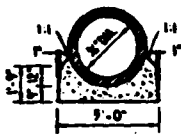
1/4" PREFORMED BIT. TYPE JOINT FILLER
ASTM SPEC. D-544-49 OR D-994-99
PAINT PIPE AND CRADLE WITH
BIT COMPOUND.



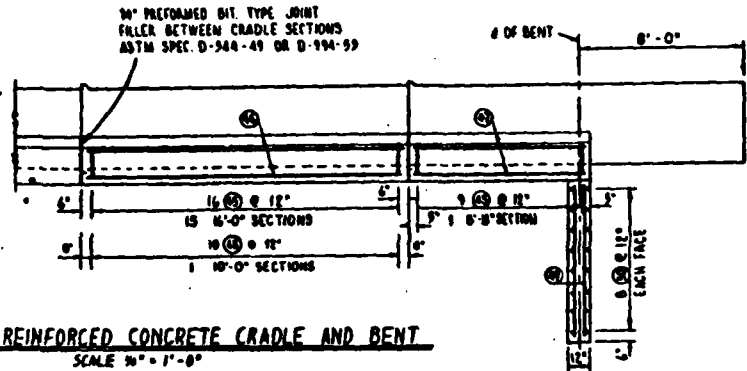
DETAILS OF REINFORCED CONCRETE ANTI-SEEP COLLAR

NOT TO SCALE

1 REQUIRED

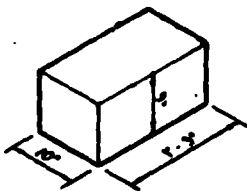


TYPICAL SECTIONS OF REINFORCED CONCRETE CRADLE

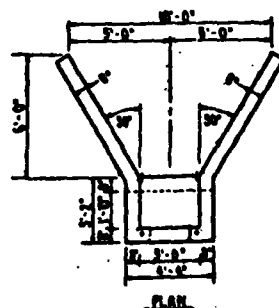


DETAILS OF REINFORCED CONCRETE CRADLE AND BENT

SCALE 1/4" = 1'-0"



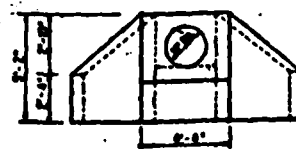
SUGGESTED CONCRETE SUPPORT BLOCK



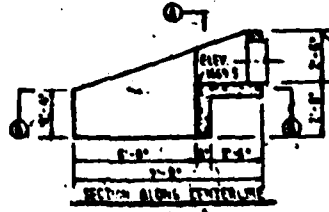
PLAN

POND DRAIN INLET BOX

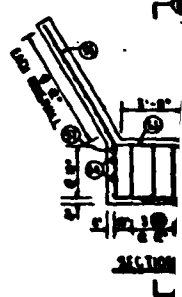
SCALE: 1/4" = 1'-0"



UPSTREAM ELEVATION



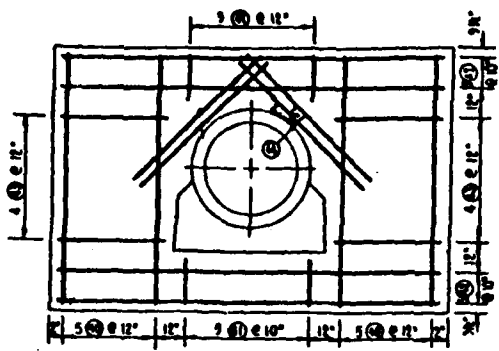
SECTION ALONG CENTERLINE



SECTION

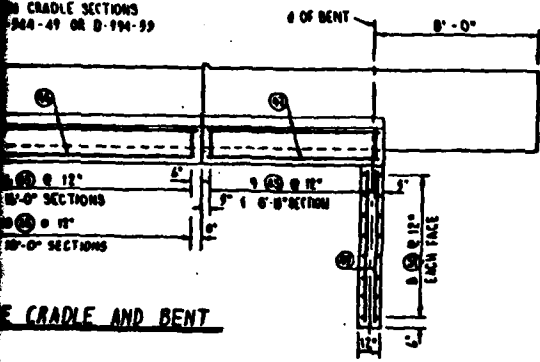


SECTION

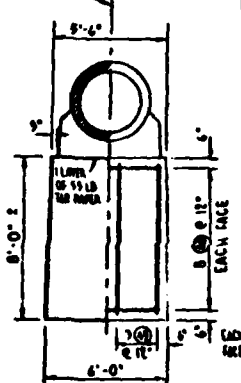


ANTI-SEEP COLLAR
7 REQUIRED

INT. TYPE JOINT
ON CRADLE SECTIONS
904-49 OR D-904-59

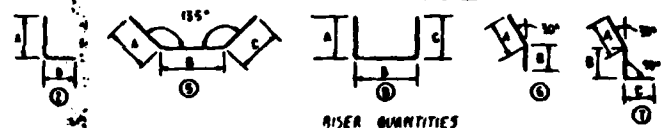


SYMMETRICAL
ABOUT A



BAR	LOCATION	W. & H.	SIZE	LENGTH	TYPE	A	B	C	TOTAL FT
40	COLLAR	18	4	8'-6"	1				154.80
41		20	4	1'-0"	1				20.00
42		22	4	1'-0"	1				22.00
43		24	4	1'-0"	1				24.00
44	CRADLE	25	4	5'-0"	2	1'-6"	2'-0"	1'-0"	114.00
45		26	4	15'-0"	1				150.00
46		27	4	15'-0"	1				150.00
47		28	4	15'-0"	1				150.00
48	BENT	29	4	15'-0"	1				150.00
49		30	4	15'-0"	1				150.00
50	WILEY BOX	31	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
51		32	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
52		33	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
53		34	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
54		35	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
55		36	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
56		37	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
57		38	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
58		39	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
59		40	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
60		41	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
61		42	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
62		43	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
63		44	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
64		45	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40
65		46	4	11'-7"	1	6'-0"	2'-0"	2'-0"	104.40

BAR TYPES



RISE QUANTITIES

STEEL
NO. 5 BARS 3657 LBS. FT. 3825 LBS.
NO. 6 BARS 3448 LBS. FT. 3119 LBS.
TOTAL 3004 LBS.

CONCRETE
CLASS "B" TYPE I 55.2 CU. YDS.

CRADLE QUANTITIES

NO. 4 BARS 2297.0 LBS. FT. 1533 LBS. CLASS "B" TYPE II 55.2 CU. YDS.

COLLAR QUANTITIES

NO. 4 BARS 1652.0 LBS. FT. 1188 LBS. CLASS "B" TYPE II 36.8 CU. YDS.

BENT QUANTITIES

NO. 5 BARS 174.0 LBS. FT. 182.0 LBS. CLASS "B" TYPE II 1.7 CU. YDS.

POND DRAIN INLET BOX QUANTITIES

NO. 4 BARS 187.0 LBS. FT. 123 LBS. CLASS "B" TYPE II 2.2 CU. YDS.

POND DRAIN PIPE BEDDING

GENERAL NOTES:

- ALL CONCRETE SHALL BE CLASS "B" AND OF THE TYPE NOTED
- PORTLAND CEMENT TYPE 1A OR TYPE 1 WITH AN AIR-ENTRAPPING ADMIXTURE SHALL BE USED.
- ALL REINFORCING STEEL TO BE LAPPED A MIN. OF 30 BAR DIA.
- ALL REINFORCING STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MIN. OF 3" COVER. WHERE FORMS ARE USED BARS SHALL HAVE MIN. OF 2" CLEAR COVER.
- ALL EXPOSED EDGES OF CONCRETE TO HAVE A 1/4" CHAMFER UNLESS OTHERWISE NOTED.

STEEL QUANTITIES FOR SITE

NO. 4 BARS 4126 LBS. FT. 2768 LBS.
NO. 5 BARS 3841 LBS. FT. 4003 LBS.
NO. 6 BARS 3448 LBS. FT. 3119 LBS.
TOTAL STEEL WT. = 11579 LBS.

CONCRETE QUANTITIES FOR SITE

CLASS "B" TYPE I 51.8 CU. YDS.
TYPE II 36.7 CU. YDS.
TYPE III 0.0 CU. YDS.

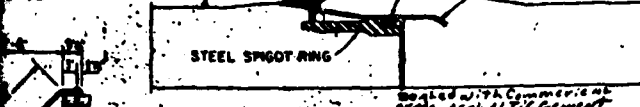
AS BUILT

ISCHUA CREEK WATERSHED PROJECT
FLOODWATER RETARDING DAM NO. 4
SAUNDERS CREEK
CATARAUGUS CO., NEW YORK
CRADLE-COLLAR AND BENT DETAILS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

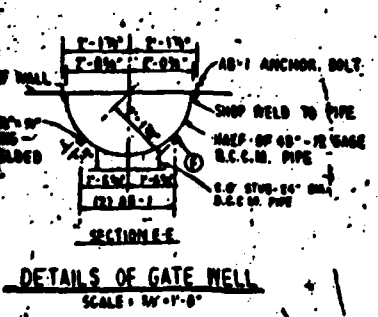
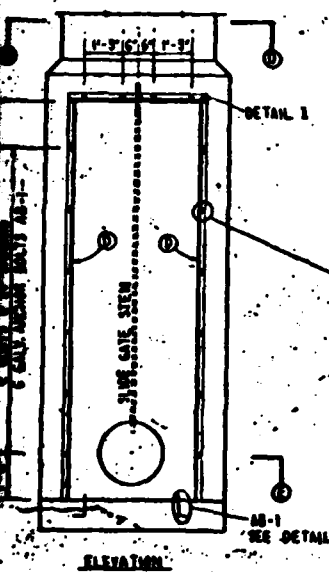
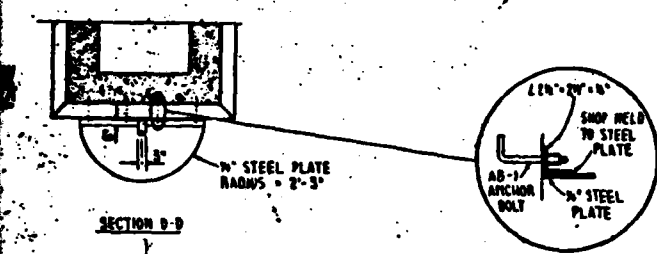
Designed by: L. BECK - B. BERNHARDT
Checked by: H. W. HARRISON
Drawn by: H. T. BROWNING, JR.
Scale: 1" = 1'-0"

Project No.: NY-804-P

ALL POINTS OF CONTACT BETWEEN PLATES AND BARS ARE WELDED.



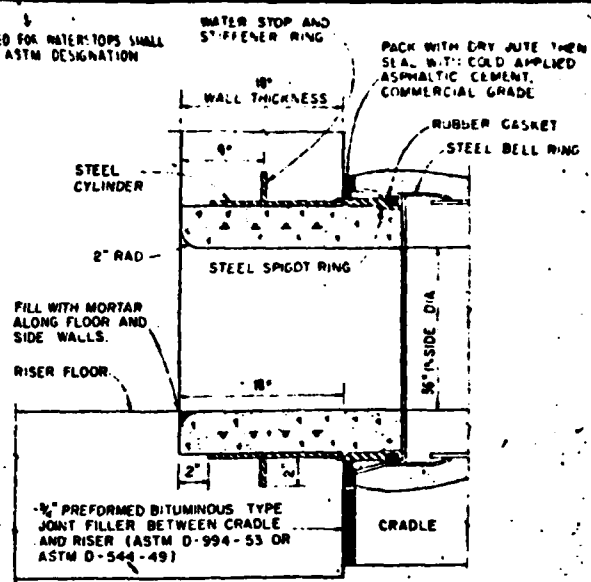
DETAIL OF REINFORCED CONCRETE WATER PIPE JOINT



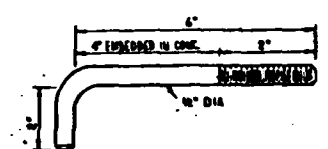
NOTE: ALL ANCHOR BOLTS SHALL BE SUPPLIED WITH NUTS AND WASHERS.

BILL OF MATERIAL				
LOCATION	ITEM	SIZE	LENGTH	QUANTITY
HIGH STAGE TRASH RACK	1/2" DIA. PIPE STD. THREADED ENDS	3/4" DIA.	11'-0"	2
	1/2" DIA. PIPE SLEEVES	3/4" DIA.	1'-0"	2
LOW STAGE TRASH RACK	1/2" ANGLE IRON	1/2" X 1/2" X 1/2"	1'-0"	2
	1/2" ANGLE IRON	1/2" X 1/2" X 1/2"	1'-0"	2
	1/2" ANGLE IRON	1/2" X 1/2" X 1/2"	1'-0"	2
	1/2" ANGLE IRON	1/2" X 1/2" X 1/2"	1'-0"	2
GATE WELL	1/2" ANGLE IRON	1/2" X 1/2" X 1/2"	1'-0"	2
	1/2" ANGLE IRON	1/2" X 1/2" X 1/2"	1'-0"	2

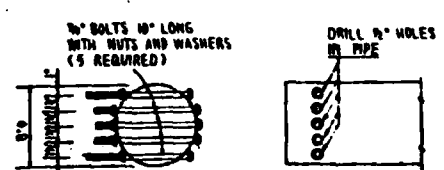
NOTES: STEEL USED FOR WATER TOPS SHALL CONFORM TO ASTM DESIGNATION A-36.



DETAIL OF WALL PIECE IN RISER



GALV. ANCHOR BOLT AB-1



DETAILS OF SMALL ANIMAL GUARD

AS BUILT

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 FLOODWATER RETARDING DAM NO. 4
 SAUNDERS CREEK
 CATTARAUGUS CO., NEW YORK

TRASH RACK-GATE WELL-MISC. DETAILS
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

DECK - 8 GERMANA SEPT 61
 W. MORGAN NOV 61
 M. HINDLICH OCT 61

NY-804